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SUPPLEMENTARY NOTES

TO THE

ATLAS STELLARUM VARIABILIUM.

I. THE NEW STAR IN PERSEUS.

II. SOME ENGRAVED CHARTS OF POGSON'S PROPOSED ATLAS.

WASHINGTON, D. C.

1901.

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SUPPLEMENTARY NOTES.

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SUPPLEMENTARY NOTES

TO THE

ATLAS STELLARUM VARIABILIUM

BY

J. G. HAGEN, S. J.

1901,

GEORGETOWN UNIVERSITY PRESS.

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I.

THE NEW STAR IN PERSEUS.

This star was announced by Dr. T. D. Anderson in Edinburgh on February 22, 1901. A first Circular was distributed by this Observatory on March 2, with a chart and catalogue for observing the new star with the naked eye or by means of a field-glass. This Circular could be published without much delay, as it is in substance a copy of Chart III and corresponding Catalogue of the V. Series of the *Atlas*, now in print. As this chart of the Atlas is adapted to the observation of β and ρ *Persei*, it does not contain the fainter comparison stars which were needed to follow the Nova below the fifth magnitude. It was therefore necessary to insert additional stars in the Circular. They all belong to the constellation of *Perseus*, and are in the neighborhood of the Nova, 21 in number, thus increasing the list of 25 in the Atlas to 73 in the Circular.

As this Chart and Catalogue will be contained in Series V of the Atlas, we reproduce here only the list of these 21 additional stars, which may be useful for the reduction of the observations. The PD. magnitudes were kindly furnished by Dr. G. Müller in advance of their publication, and the HP. magnitudes of the Circular, which had been taken from the *Revised H. P.* (vol. 44, part I.), were replaced by those of the *Photometric Durchmusterung* (vol. 45) lately published.

Bay.	Fl.	BD.	1900 R A.	1900 Decl.	PD.	H P.	Notes
	30	+43° 674	3h 11m1	+43° 39′	5m7	5m4	
	29	49 899	11.5	49 51	5.3	5.3	
	31	49 902	12.0	49 44	5.3	5.2	
l	32	42 750	14.7	42 58	5.1	5.1	
		48 913	18.8	48 46	6.3	6.0	
		48 920	20.9	48 43	5.4	4.9	
	34	49 945	22.2	49 10	4.9	4.7	
		46 760	22.5	46 36	6.5	6.2	
		46 762	23.5	46 43	7.2	7.0	
σ	35	47 843	23.5	47 39	4.6	4.5	5p0 Kr. 284.
		40 772	24.9	40 25	6.7	6.6	
	36	45 778	25.5	45 43	5.6	5.4	
		44 734	25.8	44 31	6.7	6.5	
ψ	37	47 857	29.4	47 52	4.7	4.3	
		42 795	31.2	42 15	6.6	6.3	
		45 804	37.7	45 47	6.3	6.1	
		45 811	39.0	45 22	5.9	5.6	
		43 818	42.2	43 39	6.2	5.9	
		44 801	43.1	44 40	5.8	5.7	
		48 1015	46.4	48 21	5.9	5.9	
		+47 912	3 48.8	+47 35	5.8	5.3	

A second Circular with chart and catalogue was distributed on March 19th, which is here reproduced in its original shape, except the note to No. 10, and a correction of + into — in the $\Delta\alpha$ of No. 64.

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This second chart and catalogue have been prepared for telescopic observation of the Nova. They were both made on the plan of the *Atlas Stellarum Variabilium* (Series III), except that the new star is placed 15′ south of the centre of the chart, on account of some bright stars north of the Nova, which will be needed for comparison.

An *auxiliary* chart was added to the principal one, to enable those observers who have no circles attached to their telescopes to find the Nova. They will experience little difficulty in first setting on δ Persei, which is of 3d magnitude, then passing to ψ and σ, and from there sweeping directly south along the stars indicated on the auxiliary chart, until they reach the stars nos. 2 and 3 of the principal chart.

On this chart three divisions or squares may be distinguished as regards the *density* of the stars. The large square measures one degree in each co-ordinate, and contains all the BD. stars (except +43°745, which is of 10.5 magnitude). In a smaller square, which is 30′ wide and whose centre is the Nova, all stars have been entered which are visible in our twelve-inch refractor with a power of about fifty diameters, while in the central square of only 10′ width fainter stars have been added by means of a magnifying power of about 100 diameters. Great difficulty was experienced in seeing and measuring these objects on account of the brightness of the new star.

The *positions* of all the stars within the square 30′ wide have been determined by means of a semicircular glass scale, divided into parts 3′ wide, and of a chronograph. These positions are differential with regard to the Nova as zero point. From the preface to the *Atlas*, in which the details of this method are described, we only recall the statement that the Right Ascensions are supposed to be correct within 1ˢ, while the Declinations may be erroneous by 0′.3 or even 0′.6. The positions of the stars outside this square have been computed from the BD. or the AGC., assuming the position of the Nova, given in the title of the chart, to be correct for the beginning of the year 1901.

The *magnitudes* of all the stars on the chart were determined by sequences of steps, based on at least two independent estimates. The formula for transforming these steps to the BD. scale is of the same character as those in the *Atlas*. It will be an easy matter to replace it by any other process of transformation, graphical or arithmetical, when a scale of standard magnitudes is determined by photometric means. The faintest stars near the Nova could not be properly estimated on account of the brightness of the latter.

It is well to remark that only three good nights (March 7, 14, 16) were available for making this chart, and that then the Nova was brighter than 4th magnitude. Yet it has seemed better to distribute chart and catalogue as they are without delay, in order to facilitate observation. A more accurate scale of magnitudes, for the final reduction of the observations, may be determined at any future time, when the brightness of the new star shall have faded away.

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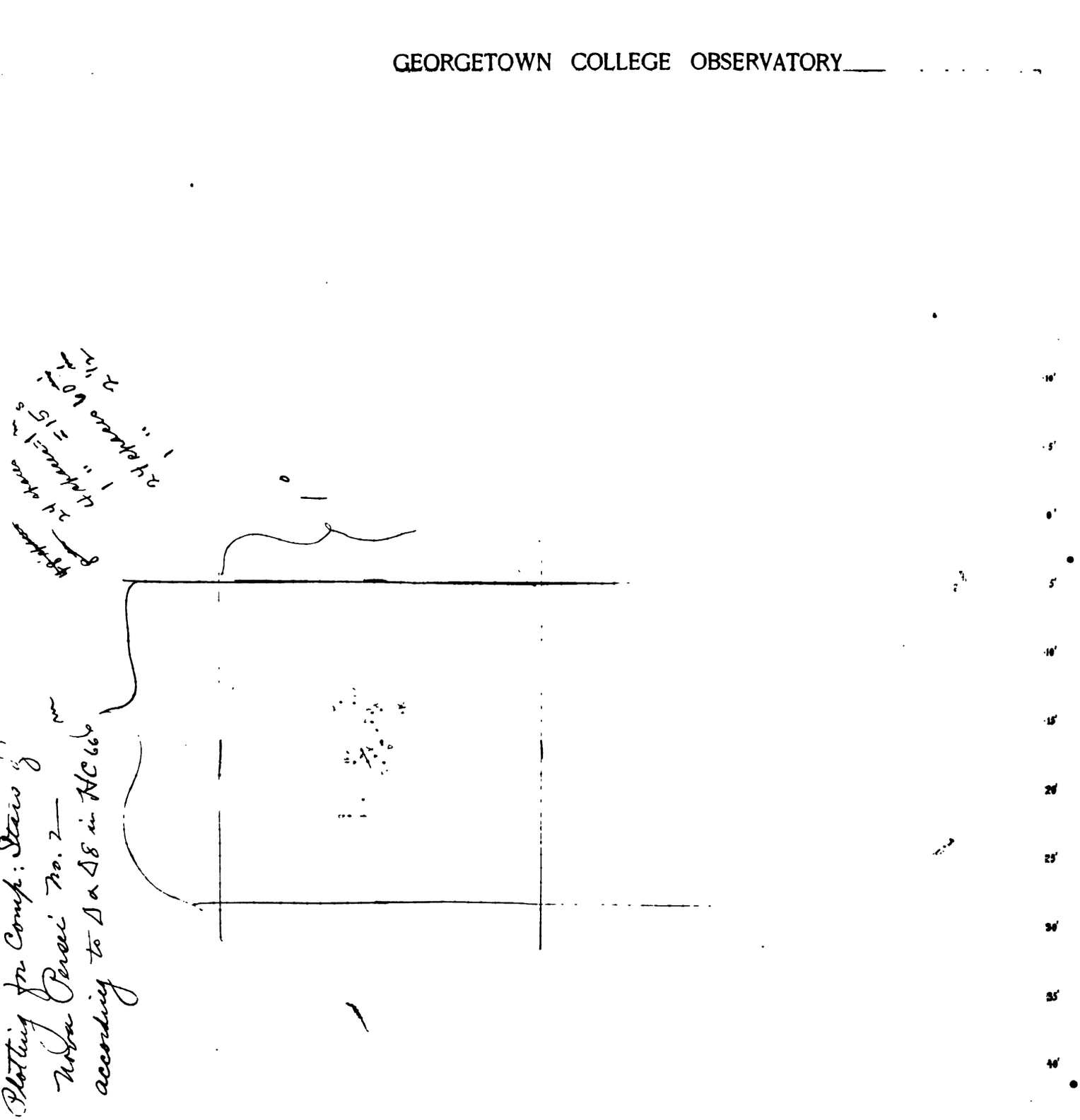

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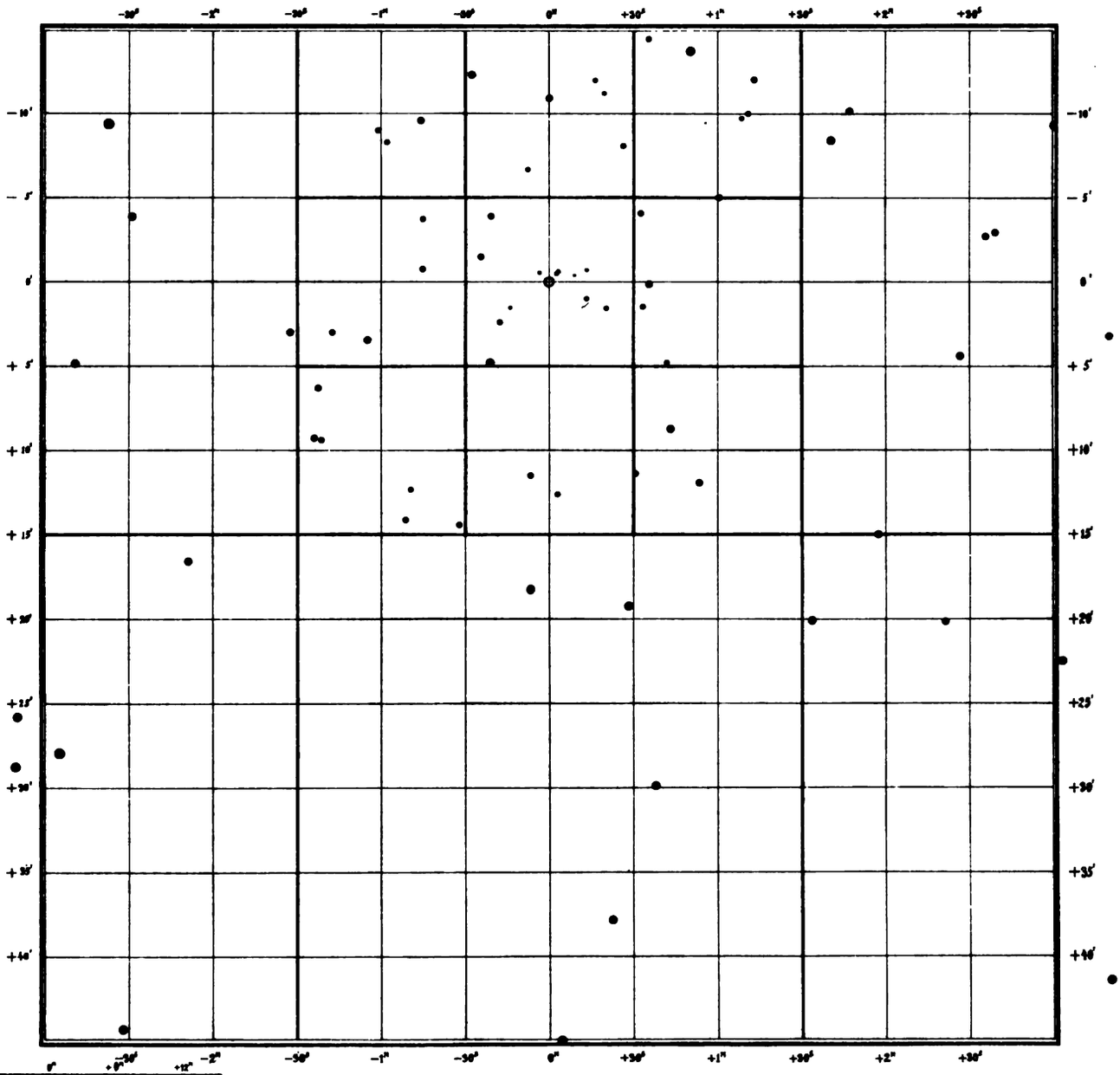
Chart II

Nova Persei

3h 24m 28s ; + 43° 33.'9.



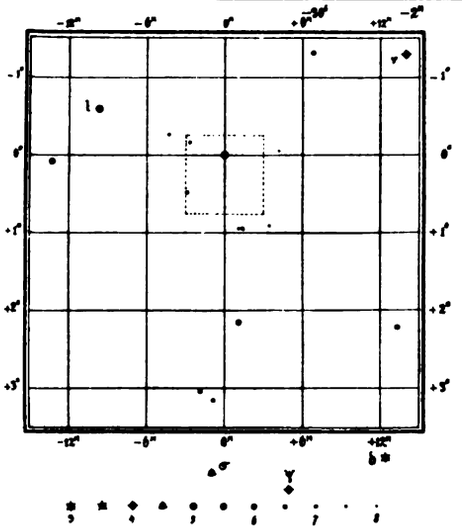


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Chart II

NOVA PERSEI

$3^h\ 24^m\ 28^s$; + 43° 33′.9.

No.	Steps	Magn.	BD.		$\Delta\alpha$	$\Delta\delta$	Notes
1	0	7ᴹ1	7ᴹ0	+43° 730	−2ᵐ 55ˢ	+27′.9	HP. 6ᴹ9; red.
2	10	7.4	6.5	44 734	+1 22	+57.3	" 6.5
3	17	7.5	7.5	44 732	+1 0	+56.3	" 7.3
4	21	7.6	7.3	44 742	+3 25	+54.4	" 7.8
5	23	7.7	7.5	43 732	−2 37	− 9.4	" 7.3
6	25	7.8	7.6	43 720	−4 15	−15.5	
7	31	7.9	8.0	43 766	+4 7	− 2.8	
8	37	8.1	8.4	43 728	−3 10	+28.7	
9	42	8.2	8.5	44 717	−0 41	+55.6	
10	(46)	(8.3)	8.9	43 726	−3 29	+15.8	See note below.
11	49	8.4	8.6	43 744	+0 51	−13.8	
12	52	8.5	8.7	43 729	−3 10	+25.7	
13	55	8.6	8.9	44 712	−2 32	+44.3	
14	59	8.7	9.1	44 741	+3 20	+41.3	
15	59	8.7	9.1	43 723	−3 51	−11.4	
16	61	8.7	8.9	44 721	+0 4	+45.0	
17	63	8.8	8.8	43 740	−0 7	+18.3	
18	65	8.8	9.1	43 746	+1 10	−22.8	
19	65	8.8	9.0	44 724	+0 23	+37.8	
20	67	8.9	9.0	43 739	−0 21	+ 4.8	
21	70	9.0	9.0	43 749	+1 41	− 8.4	
22	70	9.0	9.0	43 751	+1 50	−17.9	
23	72	9.0	9.1	43 733	−2 29	− 3.9	
24	73	9.0	9.0	43 748	+1 34	+20.1	
25	73	9.0	9.1	43 731	−2 49	+ 4.9	
26	75	9.1	9.0	43 758	+3 1	− 9.3	
27	75	9.1	9.0	43 742	+0 37	+29.9	
28	79	9.2	9.0	43 757	+2 39	− 2.9	
29	79	9.2	9.1	43 741	+0 28	+19.4	
30	80	9.2	9.2	43 759	+3 4	+22.5	
31	82	9.3	9.1	43 752	+1 58	+15.0	
32	84	9.4	9.2	43 743	+0 43	+ 8.7	
33	89	9.5	9.4	43 760	+3 20	+ 3.2	
34	92	9.6	9.5	43 735	−1 5	+ 3.4	
35	93	9.6	9.5	43 755	+2 27	+ 4.4	
36	94	9.6	9.5	+43 734	−2 9	+16.6	

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No.	Steps	Magn.	BD.		Δα	Δδ	Notes
37	96	9.7	9.5	+43° 738	—0m 28s	—12.3	
38	102	9.8	9.5	43 737	—0 46	— 9.6	
39	105	9.9	9.5	43 756	+2 36	— 2.7	
40	107	10.0	9.5	43 753	+2 21	+20.1	
41	108	10.0	9.5	+43 750	+1 47	—10.2	
42	111	10.1			+0 35	+ 0.2	
43	117	10.2			—1 32	+ 3.0	
44	120	10.3			0 0	—10.9	
45	124	10.4			—1 24	+ 9.3	
46	133	10.7			—1 22	+ 6.3	
47	134	10.7			+0 54	+11.9	
48	138	10.8			+1 1	— 5.0	
49	145	11.0			—0 24	— 1.5	
50	148	11.1			+0 31	+11.4	
51	153	11.2			—1 17	+ 3.0	
52	153	11.2			—1 21	+ 9.4	
53	158	11.3			—0 32	+14.4	
54	159	11.4			—0 21	— 3.9	
55	160	11.4			+0 36	—14.4	
56	161	11.4			—0 17	+ 2.4	
57	167	11.6			—0 6	+11.5	
58	168	11.6			—0 45	— 0.8	
59	170	11.6			+1 13	—12.0	
60	171	11.7			—0 52	+14.1	
61	172	11.7			—1 1	— 9.0	
62	175	11.8			+0 3	+12.6	
63	177	11.9			—0 49	+12.3	
64	177	11.9			—0 45	— 3.7	
65	178	11.9			+0 42	+ 4.8	
66	179	11.9			+0 33	— 4.1	
67	182	12.0			—0 58	— 8.3	
68	185	12.1			+0 34	+ 1.5	
69		(12)			+0 3	— 0.5	elongated *
70	186	12.1			+1 11	—10.0	
71	193	12.3			+0 26	— 8.1	
72	196	12.4			+1 9	— 9.7	
73	196	12.4			—0 7	— 6.6	
74	199	12.4			+0 21	+ 1.6	
75	200	12.5			+0 17	—12.0	
76	205	12.6			+0 20	—11.2	
77	209	12.7			+0 13	+ 1.0	
78	212	12.8			—0 14	+ 1.6	
79	212	12.8			+0 13	— 0.7	
80		(13)			—0 3	— 0.5	
81		(13-14)			+0 9	— 0.4	

* Professor T. J. J. See kindly examined this object with the 26-inch refractor and found it to consist of two stars which he estimated as 14th magnitude each.

Mag. = 9.0 + 0.027 (St. —71.1).

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REMARKS TO CHARTS I AND II.

The following remarks refer to the *magnitudes* and the *positions* of some of the comparison stars given in the preceding catalogues.

1. Slight variations in *brightness* have been noticed with regard to the following stars:

On Chart I the star ζ Persei seems to be of the character of ρ, with one-half of its amplitude. The estimates of various catalogues are given below in the discussion of the light curve of the Nova (page 22).

The stars κ and 36 Fl. on the same Chart were found to be slightly variable at the Bonn Observatory (A. N. 3720). The range is about half a magnitude. A final discussion of all the observations of the Nova will probably reveal other cases of the same character.

On Chart II the stars No. 2 and 10 deserve special mention. The former shows a difference of nearly a full magnitude from the BD., HP., PD., all of which give it as 6^m5. The explanation may be found in the red color of our comparison star No. 1, which was constantly estimated here about ten steps brighter than No. 2, by both observers.

The star No. 10 = BD. + 43° 726 was announced as a "new variable star 68, 1901 Persei" in the A. N. 3698, p. 29. The variability is confirmed by my own observations:

March 5 and 13: 8^m3; April 11, 17, 26, 29: 8^m0; June 19: 8^m7; June 24: 8^m9; July 15: $<9^m0$.

The statement that the photographic magnitude is far below the visual brightness of this star is borne out by a photograph taken by Rev. Father Searle on March 7, which shows many stars of magnitude 9, but no trace of the variable, while its visual magnitude was 8^m3.

2. What is stated in the preface to the Atlas about the degree of accuracy in the positions of the comparison stars is supposed to hold for Chart II, except in the immediate vicinity of the new star. All the stars within 3′ of the Nova appeared in our low-power eyepiece completely immerged in the rays of the latter, which was at the time brighter than the 4th magnitude. Their positions had to be rather guessed than measured.

Fortunately, these stars have been measured with the Lick Telescope (Publ. Astron. Soc. of the Pacif., vol. 13, pp. 68–70). A computation of the $\Delta\alpha$ and $\Delta\delta$ from the position angles and distances affords the following comparison:

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A. S. P.				Chart II.			
Star	$\Delta\alpha$	$\Delta\delta$	Mag.	Star	$\Delta\alpha$	$\Delta\delta$	Mag.
o	—19ˢ	+1′.9	12.5	56	—17ˢ	+2′.4	11.4
d	+ 5	—1.4	16.0	69	+ 3	—0.5	(12)
e	+ 7	—1.6	15.5				
i	+13	+1.2	13.0	77	+13	+1.0	12.7
l	—16	+1.1	13.2	78	—14	+1.6	12.8
j	—12	+1.4	13.5				
k	+14	—1.2	13.2	79	+13	—0.7	12.8
f	— 6	—1.8	13.0	80	— 3	—0.5	(13)
—	(— 6)	(—1.5)	——				
b	+ 8	—0.5	14.5	81	+ 9	—0.4	(13–14)
c	+ 8	—0.8	13.5				

The star between f and and b is taken from a manuscript chart made by Dr. See with the telescope of the Naval Observatory. It will be noticed that the two stars nearest the Nova, Nos. 69 and 80, show the greatest differences.

3. An interesting comparison between our Chart II and a photographic plate, taken at Oxford on February 25, was published in the M. N., vol. 61, p. 477. Some explanations will increase its usefulness. The numbers marked *O* refer to Table II on page 343 and to Table III on page 479 of that publication, while those marked *H* are taken from our Chart II.

First, it is well to state that ten stars of Table II on page 477 do not give the difference O—H but O—BD., as will appear from the introduction to Chart II. These ten stars are O: 5, 23, 68, 86, 108, 127–148.

Next, we are fortunate in clearing up a puzzle in the declinations of two stars, which apparently showed great differences from the photographic plate. The stars are the following:

H	O	$\Delta\alpha$	$\Delta\delta$	O
57	67*a*	—0ᵐ 6ˢ	+12′.6	+12′ 42″
62	73	+0 3	+11.5	+11 28

The $\Delta\delta$ are here given as they were measured, and agree with the Oxford measures in the last column. In our catalogue they were interchanged and connected with the $\Delta\alpha$ diagonally. From the catalogue the interchange was transferred on the chart, and should be corrected on both.

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A large discrepancy of 5^s in R. A. was pointed out between the stars H 71 and O 89. a We give here the $\Delta\alpha$ of the plate and our chronograph readings:

O 89 a	Feb. 25		$=31^s.2$ Plate
H 71	Mar. 7	26.5, 26.0, 26.5	$=26.3$ Tel. E.
"	June 24	25.8, 24.4, 25.7	$=25.3$ " W.

The difference between the two sets Tel. E. and Tel. W. is due to the inclination of the glass reticle, for which this chart has not been corrected. These measures prove that the two stars O 89 a and H 71 cannot be identical.

The $\Delta\alpha$ of star H 11—O 98 has been corrected in this publication to $+51^s$ from $+50^s$ of the Circular. The chronograph readings were: 50.7, 50.6, 50.6, which agree with the measure $+50^s.8$ of the Oxford plate.

After clearing up these cases, there remain three stars for which the differences O—H are given larger than 1^s in R. A., viz., —1.6, —1.1,—1.1. We here reduce these differences to their true values from the chronograph readings:

H	O	Chron.	O.	O—H
56	64	$-17^s.5$	$-18^s.7$	$-1^s.2$
68	91	+33.6	+32.8	—0.8
72	107*a*	+ 8.6	+ 7.8	—0.8

The star H 56 with the difference O—H$=-1^s.2$ occurs in the first table on page 6, of these Remarks and belongs to those close companions for which the accuracy of the Atlas is not claimed.

If we then exclude this star and those taken from the BD., there is none among those common to the photographic plate and to Chart II, whose difference in R. A., would reach 1^s. As regards the differences in Decl., if we make the corrections indicated for H 57 and 62, and again exclude the close companion H 56 for the reason mentioned, the largest residual in column O—H is given as 18″ or 0′.3.

Hence all the stars for which the normal conditions of the Atlas are realized, fully bear out the statement, that the positions are supposed to be correct within 1^s in R. A., and may be erroneous by 0′.3, or even 0′.6, the latter limit being added, because the error 0′.3 may occur as well in setting on the zero point (the variable) as on the star to be measured.

To understand the meaning of the figures in column O—H, we have to bear in mind, that they are individually fictitious and only in their mean value approximately correct. They were computed under the hypothesis that, e. g. for the star H 42 =O 92, the number $\Delta\alpha=+35^s$ meant $35^s.0$, and $\Delta\delta=+0'.2$ meant 12″, while in fact 35 means any of the ten or eleven numbers between 34.5 and 35.5, and 0′.2 means any of the seven numbers between 9″ and 15″, these numbers included. All of them have the same probability of occurrence in each single case, but in a great number of cases we may suppose that the "rounding off" makes the numbers as often and as much too large as too small. If then we correct or eliminate the cases discussed above, the *average* of 35 residuals for each co-ordinate in column O—H is

$$\pm\ 0^s.35 \text{ and } \pm\ 7''.$$

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If an inference is allowed from these figures to the Atlas, whose methods have been applied to this Chart II, imperfectly though and under unfavorable conditions, the apprehension, "that we are getting too many stars to deal with," does not seem to apply to this work, although on several charts errors have been discovered, which will be recorded in a later number of these Supplementary Notes.

The juxtaposition of the diameters of the photographic star disks and the visual magnitudes of Chart II in the Tables II, III, IV, on pp. 477-479 furnishes the material for transforming the diameters into photographic magnitudes, corresponding on the average to the visual magnitudes. The comparison, which was made here by a graphical process, only confirmed what was known before, viz., that the relative intervals between visual magnitudes differ widely from those of photographic magnitudes, especially those which are based on diameters alone.

This difference between visual and photographic magnitudes would seem to be sufficient to give preference to the visual method, against the photographic, in making charts for variable stars, at least as far as the magnitudes are concerned.

WASHINGTON, D. C., July 31, 1901.

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Preliminary Light Curve

OF

NOVA PERSEI 1901

FROM FEBRUARY 22 TO MAY 1.

A third Circular with the above title, dated June 5, was distributed by the end of June. It comprised nearly all the observations of the new star published before the middle of May, and a few unpublished ones. Since then many other observations, covering the whole time from the star's appearance to the end of April, have come to our knowledge. Others, especially the photometric observations made at the Harvard College Observatory and at the Astrophysical Observatory of Potsdam, are yet unpublished.

Before a definitive light curve, based upon the entire material, can be constructed, a long time may yet elapse. Our endeavor, therefore, to make a preliminary examination of the material on hand, especially with regard to the periodic oscillations in the brilliancy of the Nova, will not appear premature.

We here reproduce the Circular in its original shape.

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Circular III.

The observations of this new star have now passed their first stage. While the evening observations until the beginning of May could be made with the naked eye or a field glass and with the aid of the first Chart, the coming morning observations may require more powerful instruments and the comparison stars of the second Chart. In the meantime a reduction of the first series of observations seemed to be desirable to clear up the question how far the light oscillations of the Nova, which have been generally noticed, were regularly periodic. Minima of brightness were announced in the A. N. for March 13, 16, 19, 22$_7$23, 25–26, 28, 31, and an attempt was even made to express these fluctuations by the formula (A N. 3706):

$$\text{Min.} = 1901, \text{March } 22.145 \text{ (Gr. M. T.)} + 2^d.975\ E.$$

To decide this question, all the observations published up to this date were collected and, as far as this was possible, reduced to one system, and were then together with the observations made at this observatory combined into one light curve.

What system of magnitudes is chosen, is immaterial. We have taken that of the Harvard Photometric Durchmusterung (H. C. O. vol. 45). Various sets of observations, published in reduced form, had been based on the system H P. vol. 14, or on the Revision in vol. 44, I. Since these three volumes do not differ systematically, we have used all such observations as they were published. In the following tables we designate Prof. Pickering's system of magnitudes simply by the letters H P.

The sources from which the following observations have been taken, are the A. N. No. 3692 etc., the M. N. vol. 61, the Astroph. J. vol. 13, Pop. Astr. vol. 9, and some communications by letter. Observations for which the hour was not noted, and those which are merely descriptive without numerical data, have been generally omitted.

The times were all reduced to Gr. M. T., and expressed in fractions of hours and of Julian days. From the latter the common number 2415000 has been omitted.

The observations are divided into four groups (A, B, C, D). The first (A) contains the disconnected observations of the first six or seven days of the star's appearance; the second (B) all the systematic observations by steps made independently of any photometric scale; the third group (C) comprises those observations by steps which do not furnish sufficient data for an independent reduction; and the fourth (D) all those which have been published in the reduced form of magnitudes.

A correction for the absorption of light was not applied to any of the observations. For the first group this correction would not exceed the errors of observation, on account of the high altitude of the star, and in the second and third group it seems for the greater part eliminated by the nearly equal altitudes of the comparison stars, while the fourth group as published did not in all cases furnish the necessary data for the correction.

A final discussion of the light variations of the Nova would first require an inspection of the original and unreduced estimates, then a more exact reduction of all of them to a well established photometric scale of the comparison stars, the correction for absorption, and finally a simultaneous study of the variations in *brightness* and *color*. Yet even this preliminary reduction of brightness alone will bring out the general character of the light curve.

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GROUP A.

The disconnected Observations of the first week.

The earliest observations of the Nova are of a very heterogeneous character and less exact than those of the following three groups. They were made by a great many observers more or less experienced in photometric work, and were exceptionally difficult owing to the brilliancy of the star. The brightness of the Nova was in most of the publications connected with other stars of first magnitude by the signs $<$, $=$, $>$, or by differences expressed in fractions of a magnitude. A reduction to the H P. system was made wherever sufficient data were given. In the case of the Potsdam photometric measures (A. N. 3694) the reduction was based on table VIII of the P D. II, p. 459.

The material, which is scattered in the sources previously mentioned, is here put in chronological order, reduced to magnitudes, with the names and places of the observers.

1901	Gr. M. T.	Magn.	J. D.	Authority
Feb. 2, 6, 8 18, 19		$<10^{m}.5$		H. C. O. Circular 56.
20	11^{h}	<11-12		Stanley Williams
21	5.9	1.5	$437^{d}.25$	Borisiak, Kiew
"	7-10.5	<(3-4)	.29-.44	Grimmler, Plassmann, Schwab
"	14.7	2.7	.61	Anderson, Edinburgh
22	5.6	0.2	438.23	Sviatsky, Orel
"	6.7	1.3	.28	Schwab, Ilmenau
"	7.0	0.8	.29	Copeland, Edinb.
"	8.2	0.45	.34	Copeland, Edinb.
"	9.9	1.1	.41	Hartwig, Bamberg
"	11.7	1.3	.49	Hartwig, Bamberg
"	14.0	0.35	.58	Wendell, H. C. O.
"	17.4	0.39	.73	Wendell, H. C. O.
23	5.0	0.1	439.21	Borisiak, Kiew
"	5.7	0.1	.24	Köhl, Denmark
"	6	0.3	.25	Baliasny, Poltava
"	6.3	0.2	.26	Nijland, Utrecht
"	7.7	0.2	.32	Plassmann, Münster
"	8.2	0.0	.34	Halm & Clark, Edinb.
"	8.6	0.1	.36	Clemens, Kiel
"	9.0	0.2	.38	Hydrogr. Off., Pola
"	9	0.1	.40	Dolanski, Agram
"	9.2	0.0	.38	Müller & Kempf, Potsdam
"	9.6	0.1	.40	Graff, Berlin
"	9-12	0.2	.4-.5	Gautier & Pidoux, Geneva
"	11.5	0.1	.48	Kreutz, Kiel

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1901	Gr.M.T.	Magn.	J. D.	Authority.
Feb. 23	13	0.1	.54	Graff, Berlin
"	16.5	0.1	.69	Douglass, Lowell Obs.
"	18.3	0.2	.76	Brooks, Lincoln, Neb.
24	4.7	0.1	440.20	Köhl, Denmark
"	5.0	0.1	.21	Borisiak, Kiew
"	5.8	0.2	.24	Kreutz, Kiel
"	9.0	0.7	.38	Hydrogr. Off., Pola
"	11.7	0.6	.49	Clemens, Kiel
"	12	0.3	.50	Frost, Hanover, N. H.
"	14.6	1.2	.61	Archenhold, Berlin
"	15	0.6	.63	Douglass, Lowell Obs.
"	15.5	0.5	.65	Frost, Hanover, N. H.
"	16.2	1.0	.68	Mathiessen, Holstein
"	16.6	0.2	.69	Kreutz, Kiel
25	4.8	0.5	441.20	Glasenapp & Ass., Petersb.
"	5.0	0.8	.21	Borisiak, Kiew
"	6.7	0.80	.28	Köhl, Denmark
"	6.7	1.0	.28	Radcliffe Obs., Oxford
"	7.5	0.88	.31	Radcliffe Obs., Oxford
"	6 and 8	1.3	.25–.33	Kucera, Agram
"	9.0	0.9, 1.0	.37	Hydrogr. Off., Pola
"	9.7	1.4	.40	Gyllensköld, Stockholm
"	9.9	1.2	.41	Bohlin, Stockholm
"	11.5	1.06	.48	Stanley Williams, Sussex
"	(16)	1.0	.67	Douglass, Lowell, Obs.
26	4.1	1.4	442.17	Glasenapp, Petersb.
"	6.8	1.5	.28	Müller & Kempf, Potsdam
"	7	1.6	.29	Schwab, Kremsmünster
"	7	1.5	.29	Fauth, Landstuhl
"	8	1.4	.33	Graff, Berlin
"	(8)	1.5, 1.4	.33	Franz & Meyer, Breslau
"	9.0	1.4, 1.6	.37	Hydrogr. Off., Pola
"	(9)	1.4	.38	Gautier, Geneva
"	9.5	0.64	.40	Plassmann, Münster
"	9.5	0.95	.40	Radcliffe Obs., Oxford
"	10.1	1.28	.42	Radcliffe Obs., Oxford
"	11.5	1.64	.48	Stanley Williams, Sussex
"	11.5	1.6	.48	Becker & Ass., Strassburg
"	14.5–16	1.3	.61–.70	Frost, Hanover, N. H.
27	5.0	1.6	443.21	Borisiak, Kiew
"	7.3	1.50	.30	Radcliffe Obs., Oxford
"	8	1.7	.33	Schwab, Kremsmünster
"	8.3	1.7	.35	Winkler, Jena
"	9	1.75	.38	Fauth, Landstuhl
"	9.9	1.9	.41	Müller & Kempf, Potsdam

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GROUP B.

Observations Independent of Photometric Scales.

Observations of the relative brightness of stars can be made either directly by sequences, or indirectly by reference to fixed standards, artificial or natural. In a *Durchmusterung* the latter method is the only practicable one, but in the case of light curves of variable or new stars the former seems to give greater accuracy. A relative scale is obtained from a great number of estimates between the comparison stars; the numbers expressing the differences between these comparison stars and the variable seem to fit into the observer's own scale better than into a system of magnitudes established by other observers and other methods; and finally the shape of the light curve is fully brought out by the observer's own relative scale, whether its unit be visual or photometric.

For these reasons it has seemed preferable to carry out the reductions by independent scales wherever the observations afforded the necessary data. It will be seen that the program carried out here by myself and Father Zwack had this purpose in view, and that among those published up to this date, Prof. Plassmann's are the only ones that could be treated in this manner. These three sets will be designated by the letters H, Z, P.

The column "Sky" indicates the seeing in the conventional way, from I=very good to IV=bad, with the signs for faint, bright and very bright moonlight. The columns headed I and II refer to the formulas published by Schoenfeld in the *Wiener Sitzungsberichte*, vol. 42, p. 154, but in different notation, as we count the steps in the order of the magnitudes. If the observed sequence is

$$a \ \mathrm{m} \ \mathrm{N} \ \mathrm{n} \ b,$$

a being the brighter and b the fainter comparison star for the Nova N, then

$$\text{(I)} \quad \mathrm{N} = \frac{(a + \mathrm{m}) + (b - \mathrm{n})}{2},$$

$$\text{(II)} \quad \mathrm{N} = b - \mathrm{n}\,\frac{b - a}{\mathrm{n} + \mathrm{m}} = a + \mathrm{m}\,\frac{b - a}{\mathrm{n} + \mathrm{m}}.$$

In formula (II) the fraction is what Argelander has called "the step value of the evening." The first two sets (H and Z) give the original observations, the third however (P) contains only the reductions, with reference to the source of publication.

The scale of steps for the first two sets (H and Z) was constructed from both combined, as they are quite homogeneous, except that Z estimates colored stars brighter than H.

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The scale for P was constructed from the third set alone. The final results could easily be reduced to the first two sets by the formula

$$H \& Z = 20.0 + 2\,P,$$

since Prof. Plassmann's average steps proved to be almost exactly one-half of our own. The two scales are the following:

	H, Z		P	2 P+20
a	0.0			
β	7.2			
ϵ	20.0	ϵ	0.0	20.0
δ	26.0	δ	5.5	31.0
γ	33.0			
ζ	37.3			
ν	52.2	ν	13.7	47.4
κ	57.1	κ	16.9	53.8
ξ	65.2	ψ	23.2	66.4
l	78.7	l	29.8	79.6
t	84.7	x	40.1	100.2
s	94.7			
b	(111)			
a	(124)			

The identification of these stars is not needed for the construction of the light curve, except when the maxima or minima are to be expressed in magnitudes. This part of the inquiry will be found in the last section of this circular.

The last column, headed Remarks, indicates whether the observations were made with the naked eye, or with a field glass or telescope.

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1. OBSERVER H.

Conditions			Comparisons	Computation			Julian day	Remarks
1901	Gr. M. T.	Sky		I	II	Mean		
Feb'ry 27	12h3		*a* o N 8 β	—0.4		—0st4	443d51	
28	12–16		N 4 *a*	—4.0		—4.0	444.5	
March 1	13.7		*a* 7 N 0 β	+7.1		+7.1	445.57	
2	11.5–12.5		N 2 β	5.2		5.2	446.5	
3	12.0	☽☽☽	β 4 N 8 ϵ	11.6	11.5	11.6	447.50	
5	14.0		β 5 N 7 ϵ	12.6	12.5	12.6	449.58	
6	12.5		ϵ 3 N 3 δ	23.0	23.0	23.0	450.52	
7	12.3		N 0 ϵ	20.0		20.0	451.51	
9	12.5		δ 5 N 2 γ	31.0	31.0	31.0	453.52	
13	12.5	III	γ 5 ζ 3 N 2 κ	47.7	49.2	48.4	457.52	
14	12.2		ζ 5 N 5 ν 3 κ	44.8	44.8	44.8	458.51	
15	12.5	III	ζ 6 N 4 ν	45.8	46.2	46.0	459.52	
16	12.5	I	ζ 10 N 3 ν	48.3	48.8	48.6	460.52	
17	13.3	III	ζ 7 N 6 ν !	45.3	45.3	45.3	461.56	
18	13.0	III	ζ 10 N 4 ν	47.8	47.9	47.9	462.54	
19	15.2	III	ν 3 κ 10 N 3 l	67.9	73.7	70.8	463.63	
21	15.2	II	ν 3 κ 7 N 10 l !	66.4	66.0	66.2	465.63	
22	12.7	II ☽	κ 2 ξ 5 N 12 l	68.5	69.2	68.9	466.53	
24	13.8	III ☽☽	ξ 4 N 12 l	68.0	69.8	68.9	468.58	
"	14.2	"	ξ 5 N 9 l !	70.5	70.0	70.3	468.59	
"	15.5	"	ξ 7 N 8 l !	71.5	71.5	71.5	468.64	
26	14.3	III ☽☽	ν 2 N 3 κ !	54.2	54.2	54.2	470.60	
"	15.5	"	ν 3 N 2 κ !	55.2	55.2	55.2	470.64	
28	12.5	II ☽☽	ξ 10 N 3 l	75.5	75.6	75.6	472.52	N. E. difficult.
"	13.7		ξ 7 N 7 l	72.0	72.0	72.0	472.57	F. G.
29	13.8	II ☽☽	ξ 3 N 12 l	67.5	67.9	67.7	473.58	"
31	13.2	I ☽☽	ξ 3 N 13 l	67.0	67.7	66.6	475.55	N. E.
"	"		ξ 0 N	65.2			"	F. G.
April 1	12.5	III ☽☽	κ 4 N 3 ξ ! !	61.7	61.7	61.7	476.52	N. E. & F. G.
4	12.7-13.5	II ☽☽	ν 5 N 4 κ	55.2	54.9	55.1	479.5	N. E.
11	12.5	I	N 0 s	94.7		94.7	486.52	F. G.
"	14.0	II	N 0 s	94.7		94.7	486.58	"
16	13.9	I	l 6 t 7 N 3 s !	91.7	91.7	91.7	491.58	"
17	12.8	I	ξ 8 N 9 l	71.5		71.4	492.53	"
26	13.3	II	t 10 s 6 N 20 *a*	102.4	101.4	101.9	501.56	" & 12-inch.
27	13.3	I	ν 5 κ 5 N 7 ξ	60.2	60.5	60.4	502.56	"
28			N 2 mag. > *a*	[64.0]		[64.0]	503.5	12-inch, clouds.
29	13.2	I	s 3 N 1 mag. > a	[97.4]		[97.4]	504.55	"
May 4	13.0	II	s 10 N 20 *a*	104.3	104.5	104.5	509.54	"

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2. OBSERVER Z.

Conditions			Comparisons	Computation			Julian day	Remarks
1901	Gr. M. T.	Sky		I	II	Mean		
Feb'ry 27	12h 5		N 2 *a*	—2.0		—2st0	443d 52	
28	13.0		N 4 *a*	—4.0		—4.0	444.54	
"	16.5		N 4. 5 *a*	—4.5		—4.5	444.69	
March 1	13.7		*a* 3 N 4 *β*	+3.1	+3.1	+3.1	445.57	
2	14.0		*a* 1 N 6 *β* ??	1.1	1.0	1.1	446.58	
3	13.8	☽☽☽	*β* 2 N 5 *ε*	12.1	9.3	10.7	447.58	
5	12.7		*β* 11 N 2 *ε* !	18.1	18.0	18.1	449.53	
7	13.4		N 3 *ε*	17.0		17.0	451.56	
9	12.2		*β* 14 *ε* 6 *δ* 5 N 2 *γ*	31.0	31.0	31.0	453.51	
13	13.3	III-IV	*γ* 4 *ζ* 9 N 7 *κ* ?	48.2	48.4	48.3	457.56	
14	13.3	I-II	*γ* 4 *ζ* 8 N 10 *ν* 3 *κ*	43.8	43.9	43.9	458.56	
15	12.0	II	*ζ* 11 N 6 *ν*	47.3	46.9	47.1	459.50	
16	13.5	I	*ζ* 13 N 4 *ν*	49.3	48.7	49.0	460.56	
17	13.3	III	*ζ* 11 N 8 *ν*	46.3	45.4	45.9	461.56	Passing mist
18	13.0	III	*ζ* 13 N 5 *ν*	48.8	48.1	48.5	462.54	
19	15.5	III	*ν* 8 *κ* 9 N 5 l	69.9	71.0	70.5	463.65	F. G.
21	15.3	II	*ν* 5 *κ* 10 N 8 l	68.9	69.1	69.0	465.64	"
22	12.9	III	*κ* 8 *ξ* 3 N 8 l ?	69.5	68.9	69.2	466.54	Cloudy. N.E.
24	13.8	II-III	*ξ* 1 N 14 l	65.5	66.1	65.8	468.58	F. G. ,
"	14.3	"	*ξ* 3 N 12 l	67.5	67.9	67.7	468.60	"
"	15.5	"	*ξ* 5 N 11 l	69.0	69.4	69.2	468.64	"
26	15.9	II	N 3 *ν*	49.2		49.2	470.66	N. E.
28	13.6	II ☽	*ξ* 6 N 10 l	70.0	70.3	70.2	472.57	F. G.
29	14.8	☽☽	*ξ* 7 N 12 l	69.5	70.2	69.9	473.62	"
31	13.5	☽☽☽	*ν* 7 N 11 *ξ*	56.7	57.2	57.0	475.56	"
April 11	13.2	I-II	l 7 N 2 s	89.2	90.7	90.0	486.55	"
16	13.6	III	l 5 s 3 N 8 b	100.4	99.1	99.8	491.57	"
17	13.0	II-III	*ξ* 11 N 8 l	73.5	73.0	73.3	492.54	"
26	13.6	II ☽	s 6 N 15 b	98.4	104.5	101.5	501.57	"
27	13.2	I ☽	*ν* 5 N 11 *ξ*	55.6	56.3	56.0	502.55	"
29	13.2		N 30 a	[94.0]		[94.0]	504.55	5-inch Telesc.
May 4	13.3		N 12 a	[112.0]		[112.0]	509.56	" "

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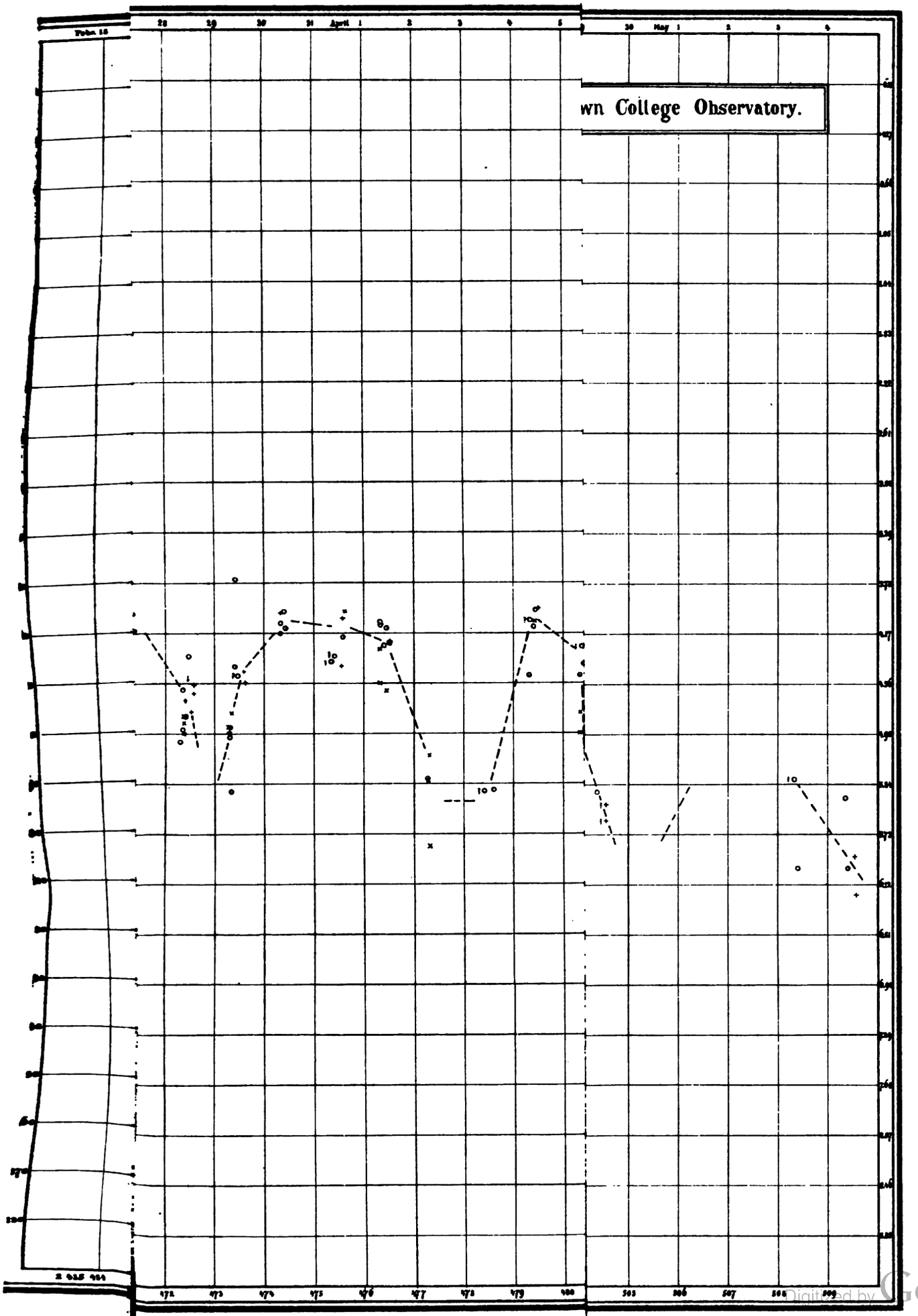

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3. OBSERVER P.

These observations have been published in the A. N. 3705. Their reduction was made by the two formulas mentioned above, separately for each estimate, as was done in the two preceding numbers. We give here only the "Mean" of the two formulas and their reduction to the scale of H & Z, and moreover contract estimates that lie close together into mean values.

1901	Gr. M.T.	Mean	2 P+20	J. D.	1901	Gr. M.T.	Mean	2P+20	J. D.
March 7	$7^h.2$	$2^{st}.2$	$24^{st}.5$	$451^d.31$	March 25	$8^h.8$	$35^{st}.0$	$90^{st}.0$	$469^d.37$
"	8.6	2.4	24.8	.36	"	9.8	35.2	90.4	.41
13	7.2	12.5	45.1	457.30	26	8.5	18.3	56.5	470.37
"	8.6	12.2	44.5	.36	27	8.2	13.0	46.0	471.34
"	9.6	12.9	45.9	.40	28	9.5	26.7	73.4	472.40
17	7.0	10.9	41.9	461.29	29	7.3	29.8	79.6	473.30
21	7.2	12.5	45.1	465.30	30	7.5	18.0	56.0	474.31
24	7.2	12.0	44.0	468.30					
"	9.0	17.0	54.0	·38					
"	10.5	18.9	57.8	.44					

GROUP C.

Observations depending on Photometric Scales.

The following observations were not made with a view of establishing an independent scale of steps. In most cases the comparison stars were used separately, without relative sequences among themselves. It was therefore necessary to assume an average step value, deduced by comparing the observations with some scale of absolute magnitudes, in the present case with that of the H. P. The reductions, which are not printed in detail, clearly show that the same accuracy as in Group B could not be obtained in this way. For the original observations we refer to the sources where they are published.

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1901	Gr. M. T.	J. D.	H P.	1901	Gr. M. T.	J. D.	H P.

1. Stratonow, Tachkent; A. N. 3709. Assumed step value = 0ᴹ076.

Mar. 7	3ʰ3	451ᵈ14	2ᴹ74	Mar. 18	5ʰ1	462ᵈ21	3ᴹ47
14	3.5	458.15	3.23	19	3.3	463.14	4.91
16	5.0	460.21	3.78	20	3.6	464.15	3.73
17	3.2	461.13	3.66	21	4.2	465.18	3.68?
18	3.4	462.14	3.43				

2. Glasenapp, Petersburgh; A. N. 3700. Assumed step value=0ᴹ079.

Mar. 19	7ʰ3	463ᵈ30	5ᴹ23	Mar. 20	8ʰ9	464ᵈ37	3ᴹ45
"	8.7	.36	5.38	"	10.0	.42	3.37
20	6.2	464.26	3.78	25	10.1	469.42	5.57
"	7.2	.30	3.80	"	12.0	.50	5.53
"	8.1	.34	3.38				

3. Schorr & Messow, Hamburg; A. N. 3711. Step values = 0ᴹ140, 0ᴹ162 resp.*

Feb. 23	5ʰ5	439ᵈ23	N$\overline{>}$0ᴹ24	Mar. 15	6ʰ8	459ᵈ28	3ᴹ36
24	7	440.29	(0.3)	"	9.7	.40	3.73
"	9.8	.41	N<0.24	20	7.5	464.31	3.61
26	8.2	442.34	(2.6)	23	10	467.42	3.70
"	8.3	.35	1.95	28	8.7	472.36	4.82
28	6	444.25	(2.2)	"	9.3	.39	4.88
Mar. 2	8	446.33	(2.1)	"	9.4	.39	4.95
3	6.2	447.26	3.0	April 1	7.8	476.33	4.30
"	12	.5	2.3	"	"	"	4.56
4	7.2	448.30	2.77	"	11.1	.46	4.62
5	8.2	449.34	(2.9)	2	7.7	477.32	5.13
7	11.3	451.47	(3.4)	"	7.8	.33	5.84
10	9	454.37	3.00				

4. Seagrave, Providence; Pop. Astr. vol. 9, p. 283. Assumed step value = 0ᴹ12.†

Feb. 24	11ʰ5	440ᵈ52	0ᴹ6	Mar. 7	11ʰ9	451ᵈ54	2ᴹ9
"	12.8	.58	0.66	"	13.2	.59	3.0
25	11.8	441.53	1.1	"	14.1	.63	2.9
"	14.8	.66	1.1	11	14.2	455.63	(3.6)
26	11.8	442.53	1.4	12	12.2	456.65	(3.3)
"	13.7	.61	1.4	"	14.0	.63	(3.3)
"	15.1	.67	1.4	17	12.2	461.55	(3.8)
27	10.9	443.50	1.8	"	13.7	.61	(3.8)
"	13.0	.58	2.1	18	12.9	462.58	(3.8)
Mar. 6	11.8	450.53	3.0	19	12.2	463.56	$5\frac{1}{2}$
"	14.2	.64	3.1				

* These observations show considerable discrepancies from other simultaneous observations.

† Those in parenthesis deduced from ρ Persei; observations agree well with those of others.

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1901	Gr. M. T.	J. D.	H P.	1901	Gr. M. T.	J. D.	H P.

5. Sperra, Ohio; Pop. Astr. vol. 9, p. 284. Assumed step value = 0ᵐ045.

Mar. 5	13ʰ 0	449ᵈ 54	2ᵐ63	Mar. 22	14ʰ 4	466ᵈ 60	N $\overline{<}$ 4
6	13.2	450.55	3.00	31	13.7	475.57	4.01
7	13.0	451.54	2.85	April 9	13.4	484.56	4.07
17	13.9	461.58	3.46	11	13.4	486.56	(4.5)
19	14.4	463.60	N $\overline{<}$ 4				

6. Archenhold, Berlin; A. N. 3711. Assumed step value = 0ᵐ108.

Mar. 4	8ʰ 4	448ᵈ 35	2ᵐ52	April 11	8ʰ 0	486ᵈ 33	5ᵐ45
15	8.9	459.37	3.68	12	8.6	487.36	4.9
17	8.5	461.35	3.68	16	7.6	491.32	5.61
24	8.2	468.34	4.09	"	8.8	.37	5.50
April 4	10.2	479.43	4.09	17			N < 5½
5	7.8	480.33	4.95	18	8.1	493.34	4.28
9	8.4	484.35	4.51	20	8.2	495.34	5.40
"	9.4	.39	4.6	"	9.6	.40	5.62

7. Epstein, Frankfurt a. M.; A. N. 3712. Time reduced by — 1ʰ

Mar. 7	9ʰ 2	451ᵈ 38	3	April 8	9ʰ 2	483.38	4ᵐ 0
8	11	452.46	2.9	9	7.5	484.31	4.3
13	10.5	457.44	4	11	8.8	486.37	5.3
14	7.8	458.33	3½	18	8.2	493.34	4.0
22	9.2	466.38	5.1	20	8.8	495.37	5½
24	7.8	468.33	4½	21	8.2	496.34	5½
26	9.4	470.39	4½	22	8.7	497.36	5½
29	8.5	473.35	4.8	23	9.8	498.41	4.8
April 5	8.5	480.35	4.8	24	8.7	499.36	5½
7	8.9	482.37	5.4	25	9.3	500.39	6.5

8. Laska, Lemberg; A. N. 3708. Assumed step value —0ᵐ13.

Feb. 28	7ʰ 4	444ᵈ 31	1ᵐ 7	Mar. 12	5ʰ 9	456ᵈ 25	3ᵐ 4
Mar. 2	5.6	446.23	2.6	15	5.6	459.23	3.6
3	5.3	447.22	2.6	16	6.0	460.25	4.3
8	5.9	452.25	3.1	17	5.9	461.25	3.8
"	8.9	.37	(3.5)	"	7.1	.30	3.6
9	6.7	453.28	3.3	19	7.9	463.33	5.1
11	6.9	455.29	3.3	20	6.9	464.29	3.4

9. Fauth, Landstuhl; A. N. 3700, 3708, 3711. Step values = 0ᵐ25, 0ᵐ19.

Mar. 15	9ʰ	459ᵈ 38	3ᵐ 4	April 18	8ʰ ½	493ᵈ 35	4ᵐ 0
16	10	460.42	3.9	19	8	494.33	5.3
19	7	463.29	(5.2)	20	8½	495.35	5.4
24	7½	468.31	4.3	22	9½	497.40	5.5
26	8	470.33	4.4	23	9	498.38	4.6
29	7	473.29	4.9	24	8½	499.35	5.8

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GROUP D.

Observations published in Magnitudes.

The observations of this group, though in great part among the very best, have for our purpose the double disadvantage, that they furnish no internal evidence about their accuracy, and that their reduction to the HP. system in several cases leaves considerable uncertainty. Fortunately the comparison stars have often been mentioned, either for the entire series as a whole, or for each estimate in particular. It did not seem desirable to print here the reductions to Gr. M. T. and to the HP., but the necessary notes are given for each observer. Those observations whose reductions seemed to be doubtful, were distinguished from the others by interrogation points.

1. *Bohlin*, Stockholm, AN. 3699, 3700.

Twelve observations from March 6 to 22. From the magnitudes of the comparison stars it appears that the reductions are based on a system which is in substance that of the HP.

2. *Harkanyi*, O Gyalla, A. N. 3706.

The twelve observations extend from February 28 to March 28. The scale of magnitudes is that of the PD. From the magnitudes of the comparison stars α, δ, ϵ Persei follows the mean reduction: HP. — PD. — $0^m.25$. The comparison star ζ Persei was not used for this equation, for reasons to be mentioned in the last section of this circular.

3. Hydrographic Office, Pola, AN. 3706.

The four observers based the 14 observations on the HP. system.

4. *Graff*, Berlin, A. N. 3709.

Fifteen observations extending from March 10 to April 4. The estimates are based on the magnitudes of our first Chart, column PD. The reduction to the other column HP. was easy, as the comparison stars are mentioned for each observation.

5. *Radcliffe* Observatory, Oxford, M.N. vol. 61, pp. 353, 392.

The observations were made by four observers, and extend from February 28 to April 10. The results are based on the HP. system, and have been contracted into 45 mean values. Those resting on a single observer are distinguished by interrogation points.

6. *Verschaffel*, Abbadia, communication by letter.

The ten observations extend from March 23 to April 19. The comparison stars are mentioned for each observation and were taken from our first Chart. The magnitudes are practically those of the HP. In the observations of March 23 and 24 the variable ρ Persei was used, but apparently without disadvantage. The observations proved to be very useful.

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7. *Parkhurst*, Yerkes Observatory, Bulletin No. 17.

Twenty-one observations, extending from February 25 to April 10, were made partly with a wedge photometer, partly "visually." The magnitudes are based on the HP. Durchmusterung. Mr. Parkhurst considers the observations marked "vis." less reliable.

8. *Soarez*, Azores, A. N. 3711.

Fourteen observations were made from March 12 until April 17, and reduced to the HP. They bear the character of great accuracy. The longitude from Greenwich was assumed to be $+ 1^h 42^m$.

9. *Carlheim-Gyllensköld*, Stockholm, A. N. 3712.

The observations, 37 in number, extend from March 12 to April 18. Those after March 22 were made with a field-glass. The magnitudes are those of the HP.

10. *Stanley Williams*, M. N. vol. 61, pp. 338, 397.

Nineteen observations are available, from February 28 to April 4, and were made down to March 18 by means of ordinary concave spectacles, later by an opera-glass. The "provisional" magnitudes are those of the HP. The observation of March 29 gives the Nova probably too bright.

11. *Köhl*, Denmark, A. N. 3709.

The twelve observations, from February 28 to April 23, are merely descriptive, without any definite scale of magnitudes. They cannot claim much weight.

12. *Riccò*, Catania, A. N. 3708.

Nine photometric observations, from March 15 to 27, without specified scale. They give the light of the Nova too faint (except on March 20) and seem to require the correction -0^m3, which however has not been applied.

13. *Müller & Kempf*, Potsdam, A. N. 3714.

Seventeen photometric observations from April 9 to 27, with comparison stars employed and their magnitudes. Their reduction to the HP. system was thus rendered easy.

14. *Ambronn* and *Meyermann*, Göttingen, A. N. 3716.

The observations extend from March 3 to April 25 and March 24 to May 7 respectively. They represent practically the HP. scale, and have been contracted into 20 and 16 daily means.

15. A few additional observations were published by *Plassmann* Münster (A. N. 3708), *Messow*, Hamburg (A. N. 3706, 3711, 3712), *Nijland*, Utrecht (A. N. 3699), *Jost*, Heidelberg (A. N. 3700), *Fauth*, Landstuhl (A. N. 3716), with partly unknown scales of magnitude.

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CONCLUSION.

The Light Curve.

1. Before these four groups could be combined into one light curve, it was necessary to establish a relation between steps and magnitudes. This is effected by the *formula:*

$$\text{Mag.} = 3^{m}48 + 0.039\ (\text{St.} - 42.2),$$

with an average residual = ± 0^{m}18, which is within the general difference between the various catalogues of the HP. system, and amounts in our light curve to 4.5 millimeters. The following table shows the comparison stars of Group B, with their individual residuals:

Perseus	Steps	H P D.	Formula	Diff.
a	0st0	1^{m}85	1^{m}83	0^{m}02
β	7.2	2.31	2.12	.19
ϵ	20.0	2.88	2.61	.27
δ	26.0	3.00	2.85	.15
γ	33.0	3.10	3.13	.03
ζ	37.3	(2.76)	3.29	——
ν	52.2	3.90	3.87	.13
κ	57.1	3.98	4.06	.18
ξ	65.2	4.01	4.38	.37
l	78.7	5.13	4.90	.23
36 — t, x	84.7	5.39	5.14	.25
30 — s	94.7	5.40	5.53	.13
Ch. II, 2—b	(111)	6.45	(6.2)	——
" 1— a	(124)	6.91	(6.7)	——

In the first column the letters a, b, s, t, x were used by H, Z and P. The designation Ch. II, 1 and 2 refers to our second Chart for Nova Persei and its numbers. The stars a and b appear here in reversed order of sequence, but were used only a few times, the former by H, the latter by Z. The magnitude of ζ in the third column does not fit into our visual scale. This star seems to be of the same variable character as ρ, with one-half of its amplitude. Its magnitude in other volumes is given as follows:

H. C. O. vol. 14 (638), Photom. — 3.1, Estim. 3.5,
" 44 (I) " 2.87 " 3.3,
BD. — 3.0, P.D. — 3.14.

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The differences between the single measures amount to half a magnitude. This case illustrates the advantage of making the observer's scale independent of catalogues.

2. The *plotted* magnitudes show many contradictions, as was to be expected from observations made by so many persons and after different methods. Instead of drawing a smooth curve through these magnitudes, as is customary for regular variables, it has seemed more correct to indicate the general drift of the dots by straight lines, leaving their connection open for the insertion of additional observations, especially the photometric ones, which are not yet published. The four groups are distinguished by different signs, and coincident signs of the same group are underlined. An interrogation point signifies that the dot could not be placed exactly from the published data. The single observations can be identified on the diagram by means of the coordinates, viz. the calendar and Julian days in the horizontal direction, and the steps and magnitudes (connected by the formula given above) vertically. It is to be remarked that the original plotting was done on a much larger scale, and that the final drawing was again reduced one-half by the photographic reproduction.

3. As to the *shape* of the light curve, besides the general decline of magnitude from the first to the sixth, there are three Minima: March 19, 22, 25, which seem to be established beyond doubt, while later ones for March 28, April 2 or 3, 6 or 7 and 10 or 11 are indicated with great probability. Four more Minima seem to have occurred until the beginning of May, which however could not be located exactly on account of the scarcity of the available observations. Previous to March 19 the Minimum on the 16th seems to be real, and perhaps four or five more, preceding each other in periods of a little over two days.

The apparent small oscillations from March 3 backward to February 24 may be the effect of systematic differences between the observations. The period of oscillation is about one day, and the same observers are generally represented in the same phase. Should additional publications prove them to be real, then the general character of this light curve would exhibit a *harmonic change of brightness of the Nova with a period gradually lengthening from one day to four and a half or five days.*

An attempt was made to represent all the Minima indicated on the plate by *arithmetical progressions* of the *second* or the *third* order, but the changes of period in the beginning of March and of April seem to be too sudden to fit into simple mathematical laws like these

As far as the light variations on February 21 and 22 are concerned, there is no evidence in the observations themselves why the oscillations indicated in the diagram should not have taken place in reality.

WASHINGTON, D. C., June 5, 1901.

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II.

POGSON'S ENGRAVED CHARTS FOR VARIABLE STARS.

The plan of the late N. R. Pogson of preparing charts for the observation of variable stars is well known to astronomers. They all admire his untiring energy in carrying on this work for thirty years, without the catalogues and recording instruments which we have now-a-days, with repeated changes of places and instruments, and among many other astronomical and official duties. At the same time they regret the incomplete state in which he left his catalogues and charts. The former are preserved in manuscript at the Harvard College Observatory. Of the latter only a few were printed for private circulation. Six of these, belonging to the library of the Royal Observatory in Edinburgh, were kindly forwarded to this observatory by Dr. R. Copeland. Later some more engraved charts were discovered by Mr. Pogson's sister, Mrs. Baxendell, and by her son. They also were kindly put at the disposal of the writer.

As Pogson's work was never published, it seemed that a reproduction of some of it might be welcomed by all interested in this branch of astronomy. Ten of his engraved charts were found to correspond to as many charts in the Atlas Stellarum Variabilium (Ser. I, II or III), and were selected for photographic reproduction. The first of these charts is accompanied by its catalogue, printed from the original manuscript, which was kindly lent for the purpose by Professor Pickering.

No. I of these *Supplementary Notes*, on the Nova of 1901, suggested the desirability of reproducing also Pogson's chart on the New Star of 1572, and to add to it for comparison d'Arrest's chart from the *Danske Vidensk. Selsk. Forhandlinger* of 1864, which publication may not be easily accessible to all.*

For the better understanding of these reproductions, some explanations may be added, drawn in part from two preliminary reports given on this same subject in the *Monthly Notices* (vol. LIX, 1898, pp. 57–61, and vol. LXI, 1901, pp. 399–401).

I. Gemma's Nova of 1572.

This title is given by Pogson to his chart of the Nova, alluding probably to the publication: "De Stella peregrina, quae superiori anno apparere coepit, Antv. 1574, 4°"; by *Gemma-Frisius Cornelis*, Professor of Medicine and Astronomy at the University of Louvain. The star is better known as Tycho's star, since Tycho recorded for posterity accurate observations of its position and brightness.

A comparison of this chart with the corresponding one of d'Arrest shows a difference in the extent and density of the field, and in the position of the Nova.

D'Arrest's chart falls entirely within Pogson's, but, in the neighborhood of the Nova, goes more than two magnitudes below the latter. In order to facilitate the comparison of the charts, the following list gives some stars which are marked by numbers, or are otherwise easily identified, on Pogson's chart, together with the corresponding numbers, magnitudes and places of d'Arrest's stars. The two notes by Hind will be mentioned later.

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* The Secretary of the Royal Academy of Denmark sent us the following courteous letter, dated September 8, 1901: Monsieur, Notre Académie apprend avec plaisir l'usage que vous allez faire de la carte de d'Arrest de notre Bulletin de 1864. Elle y consent d'autant plus volontiers que nous autres Danois nous intéressons toujours beaucoup aux travaux conçernant notre célèbre compatriote, décédé il ya précisement trois siècles, etc.

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Pogson	d'Arrest, 1865.0				Hind
10×Mag.	No.	Mag.	0h +	63°+	Mag.
108	38	9·10	15m 46s	25.'3	
111	53	9·10	15 59	25.2	
127	78	10...	16 28	26.1	
	83	11...	34	25.8	
90	99	8·9	16 49	33.1	
126	110	10·11	17 1	20.4	
121	114	10·11	17 8	26.3	11–12
	118	.15	17 10	23.8	
Comp.	129	10·11	17 18	22.9	(12)
Anon.	173	10·11	18 6	23.3	
97	210	9	19 1	23.3	
94	212	9·10	19 7	40.9	

As indicated in the second note in the M.N., Pogson's numbers were ten times the magnitude, lest the decimal points might be taken for stars. D'Arrest's star 118 is the close companion to his circle denoting the place of the Nova, and, owing to its magnitude, is, of course, missing on Pogson's chart. The star marked "comp." in the first column is Pogson's star close to his "Var.", and the following "anon." is his star midway between "Var." and 97.

In order to compare the positions of the Nova on the two charts, we have to refer to two publications by Hind and Argelander respectively. It will be found that d'Arrest followed Hind, and that Pogson took Argelander's position. Hind published a short article in the M. N. vol. 21, 1861, p. 233, where he gives the place computed by Tycho, in the latter's treatise "De Stella Nova Anni 1572," and the one computed by himself, and where he mentions the two stars in the preceding table, calling the second "rather fainter," and, "perhaps the more suspicious of the two."

Argelander published his own computation of the place in the A. N. Bd. 62, 1864, p. 273 ss. "Ueber den neuen Stern vom Jahre 1572." While Hind had reduced only "some of the measures" of Tycho, Argelander made a complete reduction, and gave the probable error of one of Tycho's distances as ± 18.″24. Referring to Hind's note he considers his own result as the "more correct" of the two.

D'Arrest made his chart before Argelander's results were published. As he reduced all his star places to the equinox of 1865.0, we put the various results together for the same epoch, taking Tycho's place from Hind's note:

Computer	Place of Nova for 1865.0			Δα	Δδ
Tycho	0h 17m 12s	+63° 24'.3	=d'Arrest 129	— 6s	+1'.4
Hind	7	23.1	= "	—11	+0.2
Argelander	20	23.9	= "	+ 2	+1.0

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The reduction to d'Arrest's star 129 was added, because Hind considered this star as "the more suspicious of the two" mentioned by him, and because Argelander stated, that it lies within the uncertainty of his own results.

Pogson worked at his chart of "Gemma's Nova" between 1863 and 1868. From his manuscript catalogue we copy the following three lines (equinox 1860.0):

var.	0^h	16^m	51^s	+ 63° 21.7	Hind, by computation.
11·12	16	54		24.5	" " observation.
12	17	2		21.3	Schönfeld.

The first of these three positions is *not* entered on his chart. The other two designate the two stars of Hind (or d'Arrest's 114 and 129). The name Schönfeld evidently refers to Schönfeld's I. Catalogue of Variable Stars (1866), in which Argelander's position for B Cassiopeiae is given, and where d'Arrest's star 129 is mentioned (Notes, page 74).

Both charts are somewhat defective in the relative Declination: Nova — 129, this $\Delta\delta$ being too small on Pogson's chart, and too large on that of d'Arrest. Yet owing to the uncertainty in Tycho's measures all these places lie within the circle of probability of the true position of the Nova.

II. Ten of Pogson's Engraved Charts.

The following is an index of these charts, with the present notation of the Variables, with that of Pogson, and with some additional columns, to be explained below:

Present Notation			Pogson's Notation	Commenced		Missing in	
No.	Name	Ser.		Year	Place	P	H
112	R Andromedae	III	R Andromedae 1	1865	Madras	6	1
161	T Piscium	II	T Piscium 3	1859	Hartwell	6	0
434	S "	II	S " 2	"	"	9	0
513	R "	II	R " 1	"	"	11	0
2528	R Geminorum	II	Gemini 2	"	"	19	0
3825	R Ursae Maj.	III	Ursa Maj. 1	1863	Madras	9	0
4377	T Virginis	I	T Virginis 4	1864	"	1	0
4511	T Ursae Maj.	III	T Ursa Maj. 3	"	"	7	1
4557	S " "	III	Ursa Maj. 2	1853	Radcliffe	3	0
7045	R Cygni	III	Cygnus 3	"	"	20	2

The first two columns are taken from Chandler's Catalogues. The third, headed: *Series*, will facilitate the finding of the corresponding chart in the *Atlas Stellarum Variabilium*. In Pogson's notation, the numbers 1, 2, 3 generally agree with the order of Argelander's letters R, S, T. The three cases, which show a disagreement in this respect, may be accounted for by Bayer's notation, like ζ Geminorum and χ Cygni, designating stars already known as variables, or by pseudo-variables, at least 21 of which were in Pogson's working list.

The year and place, when and where each chart is said to have been commenced, are taken from the manuscript catalogues and from other data, which are mentioned in the article *M. N.*, vol. LIX, page 60, according to which he worked on his charts at the Radcliffe Observatory from 1853 to 1858, at the Hartwell Observatory from 1859 to 1860, and in Madras from 1861 to 1882. He commenced his first chart at the age of 24, and his last nine years before his death. The

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chart 3825, though commenced in 1863, seems to have been printed in England, since the original is of the same style as 2528, 4557, 7045.

The last two columns are the result of a comparison between Pogson's charts and those of the Atlas, and indicate the numbers of stars missing in one but contained in the other. It is not certain, however, whether those marked under H designate real or spurious dots. In the case of chart 112, for which we reprint the catalogue, the dot marked as missing in H, is on Pogson's chart nf. the star 11·12, $0^h\ 16^m\ 17^s + 37°55.'5$, but is not found in his catalogue. A similar examination for charts 4511 and 7045 has not been made. The comparison is of course confined to the field within which the Atlas contains the faint comparison stars visible in our 12-inch refractor, viz. to the square 30′ wide, with the variable in the centre. Outside of this area, Pogson's charts (which are 80′ wide in each direction) contain a great many fainter stars, which according to the plan of the Atlas were not entered on the charts of the first three Series.

As regards the general character of the enclosed charts, they are photographic reproductions of the original engravings, exactly of the size of the latter. The epoch of the projections is 1860, according to the manuscript catalogues. The numbers added to some of the stars are ten times the assumed magnitudes, as we learn from Professor Turner's editorial notes to the "Observations of Twenty-three Variable Stars," by the late George Knott, London, 1899 (Mem. R. A. S., vol. LII). On pages 150, 162, 204 of Knott's "Observations" there are three diagrams which will be recognized as copies of three of Pogson's charts in the present collection. The original engravings had been pasted by Mr. Knott in his ledgers of Variable Stars, as we learn from the editor, Professor Turner (M. N. vol. LXI, p. 400).

III. Pogson's Manuscript Catalogue for R Andromedae.

The following table is an exact copy of the manuscript. Those titles or parts of titles which are in parenthesis, were added for the sake of clearness.

R Andromedae Var. 1.—*Approximate Places of Stars Reduced to 1860.*—$0^h 16^m.5 + 37°50'$.

Mag.	Mean α	Mean δ	(Notes)
	h m s	° ′	Centre of
	0 16 30	+37 50	Map.
c=	+3ˢ.148	+0·0045dα^m	Secular
		+0.0000dδ'	Variation
c′=	+20″.00	−0.006dα^m	
			(*I. Authorities.*)
			Lalande Baily's.
7½	0 12 42	+37 28.1	335–6
5½	13 45	37 11.3	376–7–8
9	13 47	37 37.8	380
7.3	14 12	37 24.7	396–7
7.5	15 34	37 58.7	421
8.5	0 17 41	+38 22.0	488
8.5	0 17 42	+38 15.6	489
8	19 43	38 0.3	561
9.5	20 1	37 43.3	572
9.5	20 33	38 11.0	591
8.5	0 21 10	+38 18.9	618
			Weisse's Bessel North.
7	0 13 45	+37 11.6	353
9	13 49	37 37.7	356
9	15 46	37 21.9	395
7	16 40	37 48.0	420
9	17 27	37 57.8	435
8·9	18 24	38 5.2	460
9	18 53	38 10.2	469
8	19 42	38 0.1	489
9	20 33	38 10.9	512
8·9	0 21 10	+38 18.9	530

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R. Andromedae Var. 1.—*Approximate Places of Stars Reduced to 1860.*—$0^h\ 16^m.5 + 37°50'$.

Mag.	Mean α	Mean δ	(Notes)
	(II.) Fundamental List.		
	h m s	° ′	
7·8	0 12 42	+37 28.1	L².
6	13 45	37 11.5	B. L³.
9	13 48	37 37.7	B. L.
7	14 12	37 24.7	L².
10	15 2	37 37.0	Schönfeld c=18.9
7·8	15 34	37 58.7	L.
10·11	15 45	37 40.3	Schönfeld b=14.2
9	15 46	37 21.9	B.
11	16 9	37 48.3	Schönfeld d=22.3
	16 10	36 39.4	Schönfeld g′=35.9
Var.	16 40	37 48.0	B.
9	17 27	37 57.8	B.
8·9	17 41	38 22.0	L.
8·9	17 42	38 15.6	L.
8·9	18 24	38 5.2	B. Sch. g=31.5
10	18 46	37 33.7	Schönfeld f=26.6
9	18 53	38 10.2	B.
8	19 42	38 0.2	B. L. Sch. h=40.0
9·10	20 1	37 43.3	L.
9	20 33	38 10.9	B. L.
8·9	0 21 10	+38 18.9	B. L.
	(III. The four Zones.)		
	1863 Nov. 26. Madras.		+ 37° 20′±10′
8	0 12 41	+37 27.5	L²
10	12 43	37 29	
6	13 45	37 11.5	B. L³
12	13 52	37 19.5	
8	14 13	37 24.5	L²
11·12	14 17	37 21.5	
11·12	14 17	37 12	
11	14 27	37 11	
12	14 33	37 11.5	
12	14 39	37 13	
12	14 45	37 10	
10·11	14 52	37 24.5	
12	14 55	37 12.5	
10·11	14 56	37 29.5	
11·12	15 2	37 15	
12	15 19	37 9	
12	0 15 44	+37 14.5	
10	0 15 45	+37 22	B
12	15 45	37 15	
12	16 22	37 23.5	
12	17 11	37 8.5	
10	17 20	37 10.5	
11·12	17 27	37 23.5	
11·12	17 39	37 24.5	
11	18 2	37 30	
12	18 34	37 19	
10·11	18 41	37 19.5	
9	18 46	37 28.5	
11	19 37	37 29.5	
10·11	19 56	37 12	
10	20 3	37 10	
9.10	20 8	37 22	
10	0 20 11	+37 19.5	33 stars.
	Madras 1863 Dec. 10.		+ 37°40′±10′.
10	0 12 41	+37 37.5	
11	12 43	37 28	
12	12 47	37 49	
12	12 50	37 41	
12	13 4	37 38	
12	13 13	37 38.5	
8.9	13 24	37 45.5	
9	13 25	37 33	
8.9	13 48	37 37.5	B. L.
12	14 0	37.41	
9	14 15	37 47.5	
9	14 17	37 48.5	
11	14 21	37 46.5	
12	14 45	37 41.5	
12	14 51	37 41.5	
11	14 57	37 48	
11	14 57	37 29	
10·11	15 2	37 43	
10	15 4	37 37	Schönfeld c.
10·11	15 48	37 40	Schönfeld b.
12	15 55	37 43	
12	16 4	37 38	
12	16 11	37 49	
11	16 10	37 48	Schönfeld d.
12	16 24	37 43	
12	16 33	37 31	
12	0 16 40	+37 44.5	

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R Andromedae Var. 1.—*Approximate Places of Stars Reduced to 1860.*—$0^h\ 16^m.5 + 37°50'$.

Mag.	Mean α	Mean δ	(Notes)
	h m s	° ′	
9	0 16 40	+37 48	B. Variable
11	16 44	37 46.5	
12	16 55	37 43.5	
10	17 2	37 36.5	
9	17 6	37 34	
11	17 10	37 39	
12	17 51	37 43	
10·11	18 3	37 29.5	
11	18 10	37 38.5	
12	18 32	37 43	
9	18 47	37 38	
9	18 47	37 28	
10	18 57	37 33.5	Schönfeld f+10s
11	19 0	37 34.5	
11	19 4	37 48.5	
11·12	19 12	37 37	
11·12	19 14	37 32	
12	19 33	37 46.5	
10	19 38	37 28.5	
11	19 42	37 31	
11	19 48	37 44	
9	0 20 2	+37 43	L. 49 stars.
Madras 1863 Dec. 15.			+38°0′±10′
12	0 12 45	+37 49	
12	12 49	38 9	
12	13 22	37 53	
11	13 36	37 54.5	
10	13 39	37 59.5	
10	13 53	37 59	
12	13 55	37 54.5	
12	13 9	37 54.5	
12	14 2	37 57	
11·12	14 5	38 3	
11·	14 6	38 4	
9·10	14 22	38 9.5	
11·12	14 55	37 49	
11	15 15	37 50.5	
10	15 19	37 58	
11·12	15 21	38 3.5	
11·12	15 30	37 51	
7·8	15 34	37 58.5	L
11	15 34	38 2	
11	15 45	38 0	
11	16 6	38 2.5	
11·12	16 7	37 55.5	
12	16 54	37 55.5	
13	17 0	37 58	
9·10	0 17 26	+37 57.5	B
8·9	0 18 24	+38 4.5	Schönfeld g
9	18 53	38 10	B
10	19 0	37 54	
10	19 1	37 49	
12	19 31	37 56.5	
7	19 42	37 59.8	B. L. Schönfeld h
9·10	19 42	37 54.5	
10·11	19 51	37 55	
12	19 52	37 51	
11·12	19 59	37 49.5	
12	20 20	37 51.5	
11	20 25	37 55	
11	0 20 26	+37 54.5	38 stars.
Madras 1863 Dec. 16.			+38°20′±10′
10·11	0 12 42	+38 16.5	
10	12 50	38 18	
11	12 50	38 9.5	
12	13 8	38 19.5	
12	13 25	38 25.5	
11	13 26	38 20	
12	13 52	38 18	
12	13 55	38 23.5	
10	13 58	38 15.5	
12	14 19	38 15.5	
12	14 19	38 23	
12	14 20	38 30	
9	14 23	38 10	
12	14 23	38 20	
10·11	14 32	38 18	
11	14 33	38 23	
11·12	14 56	38 15	
9	15 6	38 16.5	
11	15 11	38 25.5	
12	15 36	38 22	
9	15 39	38 21.3	
12	15 46	38 32	
12	15 56	38 17.5	
12	16 0	38 28	
12	16 11	38 18.5	
11	16 14	38 21.5	
10·11	16 16	38 14.5	
11·12	16 31	38 32	
11	16 33	38 31	
12	16 54	38 21	
11	17 7	38 30.5	
12·13	17 23	38 11.5	
7.8	17 41	38 22.3	L.
7.8	0 17 43	+38 15.5	L.

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R Andromedae Var. 1.—*Approximate Places of Stars Reduced to 1860.*—$0^h\ 16^m.5 + 37°50'$.

Mag.	Mean α	Mean δ	(Notes)
	h m s	° ′	
10·11	0 18 2	+38 21	
9·10	18 54	38 10	
12	18 54	38 30	
9·10	19 19	38 32	
12	19 46	38 22.5	
10·11	19 48	38 12.5	
12	19 53	38 10.5	
11	20 0	38 20	
10	20 5	38 26	
13	20 22	38 25	
8.9	20 33	38 11	B. L.
13	20 33	38 17	
12	20 37	38 18.5	
9	20 44	38 20.5	
10	20 51	38 14.5	
12	21 4	38 16.5	
8	0 21 11	+38 18.7	B. L. 51 stars

(*IV.*) *Interpolations.*

1864 October 7.

12	0 13 33	+37 29.5	
12	17 9	37 26	
12	17 10	37 28.5	
12	18 59	37 11.5	
12	19 5	37 19.5	
12	19 7	37 23.5	
12	17 8	37 48	
12	17 36	37 46.5	
12	18 38	37 49.5	
13	19 16	37 41.5	
12	15 52	38 4	
12	17 30	38 7.5	
12	16 2	38 20.5	
12	0 16 9	+38 16.5	

1866 January 14.

13	0 14 18	+37 27.5	
12·13	15 10	37 15.5	
12	0 17 20	+37 30.5	

1866 January 16.

13	0 14 4	+37 49.7	
12·13	14 6	37 50.4	
12·13	14 22	37 38.3	
12·13	16 11	37 45	
12·13	14 45	38 7.5	
13	14 54	38 1.5	
12·13	19 6	37 56.9	
13	19 22	37 59.7	
12·13	13 12	38 27	
11	17 36	38 32.5	
10	0 17 54	+38 34	

1866 February 3

11	0 17 53	+37 9.5	

1867 January 10

13	0 15 3	+37 58	
12·13	13 29	38 13	
12·13	16 20	38 18	
12	17 17	38 30	
12·13	20 3	38 17.5	
12·13	0 20 7	+38 19.3	

1867 January 23.

12·13	0 15 21	+37 26.3	
12·13	17 32	37 26	
11	20 6	37 28	
12	15 36	38 1	
12	20 2	37 53.5	
12	18 3	38 30	
13	0 18 42	+38 22.3	

The *Notes* easily explain themselves. Thus B.L.^{3} means: one position from Bessel and three from Lalande. The name Schönfeld denotes his publication in the *Wiener Sitzungsberichte*, Bd. 44, page 531. The letters *b*, *c*, *d*, *f*, *g*, *g'*, *h* are Schönfeld's designations of his seven comparison stars, and the numbers appended are the steps of his scale.* The positions of these compar-

*Two copying mistakes were corrected: Pogson has g — 35.9 for g', and h — 41.0 for 40.0.

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ison stars in the Fundamental List are those of the BD., but the magnitudes assigned to them seem to be Pogson's own. The magnitude given to the variable in Zone 40′±10, was probably its actual magnitude on December 10, as that of Bessel is 7.

A critical investigation into the various Notes of the Catalogue, or a detailed identification of all the stars on the Chart, would fall without the purpose of this publication.

This catalogue will serve as an illustration to the following outline of Pogson's work, which is partly drawn from the first article in the M. N. (vol. LIX, pp. 58–59).

There is no introduction in Pogson's manuscripts to give information on his plan, his methods or the instruments used; yet the charts and catalogues themselves, with a few interspersed manuscript notes, give a pretty fair idea of his work.

The *general plan* of the work comprised all the telescopic variables in the northern and southern hemispheres, also a great number of suspected variables, and finally the temporary stars. There is no reference to the naked-eye variables. For each variable a separate chart with catalogue was contemplated, except when two or three variables are sufficiently close to each other. Each chart was to measure 1° 20′ in declination, and a corresponding amount in right ascension, and was to comprise all the stars in this area down to the 13th magnitude. On a very few catalogue sheets the magnitudes go as far as the 14th, while in some they reach only $12\frac{1}{2}^{M}$, according to the progress of the "interpolations," which will be mentioned below. The original plan seems to have fixed the limit of magnitudes at 12^{M}, for in a note to *S Virginis*, in 1862, Pogson says: "Many minute stars have of late been observed much too faint for insertion in any map as 12 mag."

About the *instrumental equipment* and *methods of observation* we learn from the manuscripts that equatorials were used with magnifying powers of 84 (from 1859 December), 52 (in 1860), and 70 (from 1865 April), and a field of view of over half a degree. Several "reticles" are mentioned: "a new reticle adapted for general use" in 1859 (note to *o Ceti*), a "Smythian telescope reticle applied to the equatorial by Lerebours and Secretan" in 1865 (note to *R Aurigæ*), and finally a "new reticle made by Messrs. P. Cir (?) & Sens, Madras," in 1875 (note to *U Cephei*, p. 2). Of what material or in what shape these reticles were made is not recorded. However from a slip referring to the catalogue of *T Cassiopeiæ* (commenced in 1874) it is possible to compute the scale value of the reticle then used. From several "interpolated" stars it follows that one division=2′.5.

The observations were arranged by Pogson in such a way that he first "noted the magnitudes and declinations," and then several days or weeks later "put in the right ascensions" (notes to *S Virginis* and *R Herculis*, 1862-63).

His estimates of brightness were not made by intervals or steps, but directly to full magnitudes, without decimals. Half magnitudes are found near the limit of visibility, like 12·13 or 13·14.

The declinations were estimated by tenths of a scale division. Hence for the scale value 2′·5 they may have reached an exactness of a quarter of a minute.

The right ascensions were determined in strips which had generally a width of 20′ in declination, but sometimes of 30′ or of 10′, according to the density of the field of view. After these strips or zones were finished, fainter stars were inserted by "interpolation," usually several years later. Some star, bright or faint, was taken as zero point, and others connected with it by notes like the following: 12, 2.5sf. 5, or 12·13, 1 nf. 25, which, from a comparison with the catalogue, must be interpreted as follows: 12^{M}, $-6'.2+5^{s}$ and $12{\cdot}13^{M}+2'.5+25^{s}$ respectively.

The *catalogue* for each variable star consists of four parts: First, an extract of fundamental stars from meridian observations (Argelander, Bessel, Brisbane, Cape, Cordoba, Lacaille, Lalande,

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Madras, Radcliffe), to which are added comparison stars determined by Chacornac, Winnecke, or Schönfeld. Secondly, a fundamental list of stars made from these extracts and reduced to 1860.0. Reductions to 1900.0 are prepared on separate sheets, but were not carried out. The third part of the catalogue gives the magnitudes and star-places in four distinct zones, each 20′ wide. The magnitudes are given without decimals, as was mentioned before. The positions are not given differentially from the variable, but absolutely for the equinox of 1860·0, to full seconds of time and tenths of a minute of arc. They are the result of Pogson's own determinations. The fourth part of the catalogue contains the fainter stars determined by interpolation.

The number of catalogues which seem to be complete is:

84 variables with faint minima ($< 10^M$),
22 " " bright " ($\geq 10^M$),
21 suspected variables (never confirmed),
7 temporary stars, or

134 in all.

In these catalogues there is no difference as to the limit of magnitude, whether the variable have a faint or a bright minimum, all being carried down to 13^M.

Of the unconfirmed variables 10 seem to have been suspected by Pogson himself, since they are not found in any catalogue of variable stars; 5 of them occur in Schönfeld's Catalogues I. or II., but are marked as doubtful; and the remainder are mentioned by Gore or Gould as suspected of variability. The catalogues of these objects are as elaborate as the others, the number of stars contained being on the average over 200, and the limit of magnitude 13^M.

Of the temporary stars 3 are ancient (of 1572, 1600, and 1604), the other 4 were contemporary with Pogson, that of 1863 having been seen by himself only.

The above statistics of Pogson's manscripts suggest a few statements regarding the Atlas Stellarum Variabilium.

The charts for variables with faint minima ($<10^M$), as published in the first three Series, number 128. A supplementary list of 51 is now under observation and partly finished.

The telescopic variables with *bright* minima ($\geq 10^M$) will form the IV. Series, which comprises for the present 55 charts, to be supplemented later. These charts have the same size and shape as those of Series I, II, III, but their area is 2° square, or four times as large as that of the latter. This Series will soon be ready for the press.

The V. Series, which is in the hands of the engraver, contains 39 *naked eye* variables on 17 charts. These charts have the same size as in the other Series, but their projection is conical and the area varies from one chart to another.

Suspected and *temporary* stars are excluded from the Atlas.

Pogson's work on stars suspected of variability was rewarded by the discovery of at least fourteen new variables. Yet to make elaborate charts for objects, whose variability is confessedly doubtful, would be a great loss of time to the author, and a needless expense to the subscribers.

As regards the temporary stars, they are not variable stars in the proper sense of the term as now used, and do not belong to a catalogue or atlas of variable stars. Interspersed among the variables properly so called they are apt to mislead observers to waste their time on them.

Finally for the sake of historical exactness, we may be allowed to repeat from the first article in the M.N. the statement, that the plan of the Atlas was laid out previous to any knowledge of Pogson's work, and that its observations were practically finished before his manuscripts were examined.

From the specimen given in this Note, astronomers will be able to judge for themselves, in what manner Pogson's manuscripts could be made useful to their science.

WASHINGTON, D. C., *September* 15, 1901.

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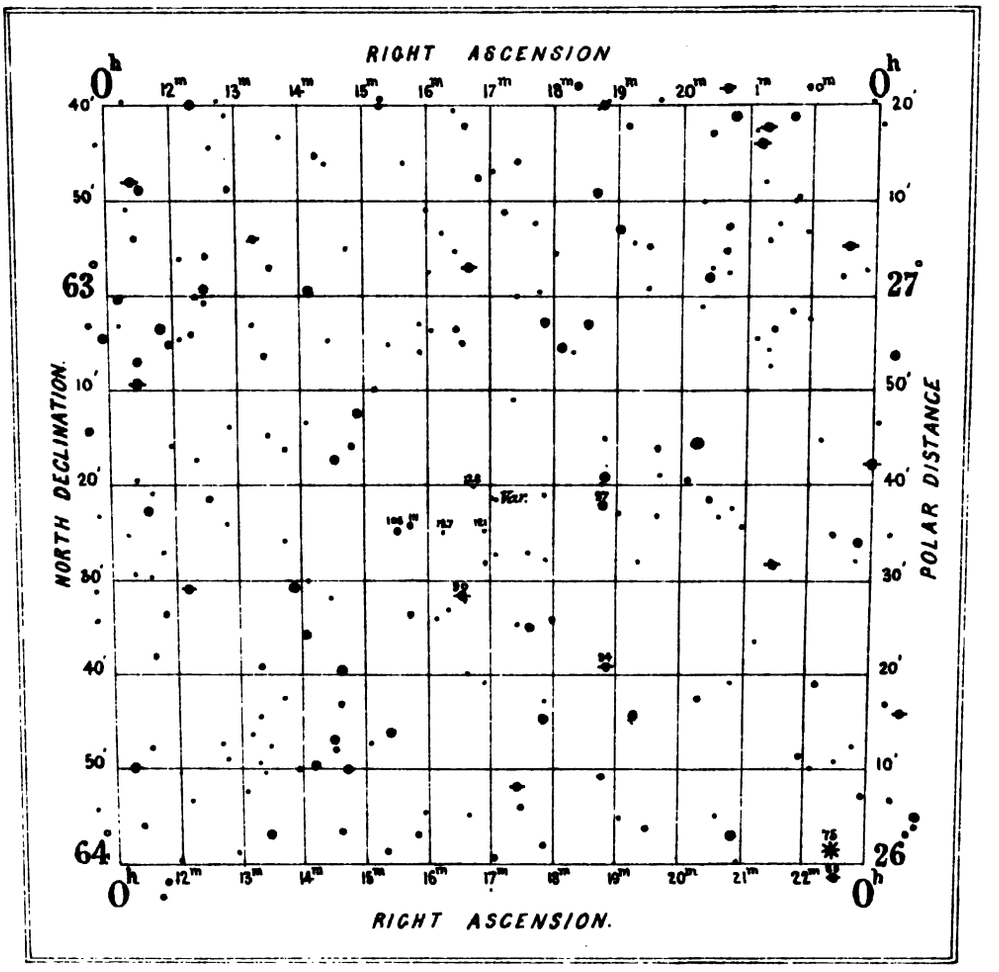
K Cassiopeæ.

GEMMA'S NOVA OF 1572.

B CASSIOPEIÆ VAR. 1.



RANGE_ Exceeding Venus at greatest brilliancy to below 12$\frac{th}{m}$ Magnitude.

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PHOTO LITH. BY A. HOLLAND

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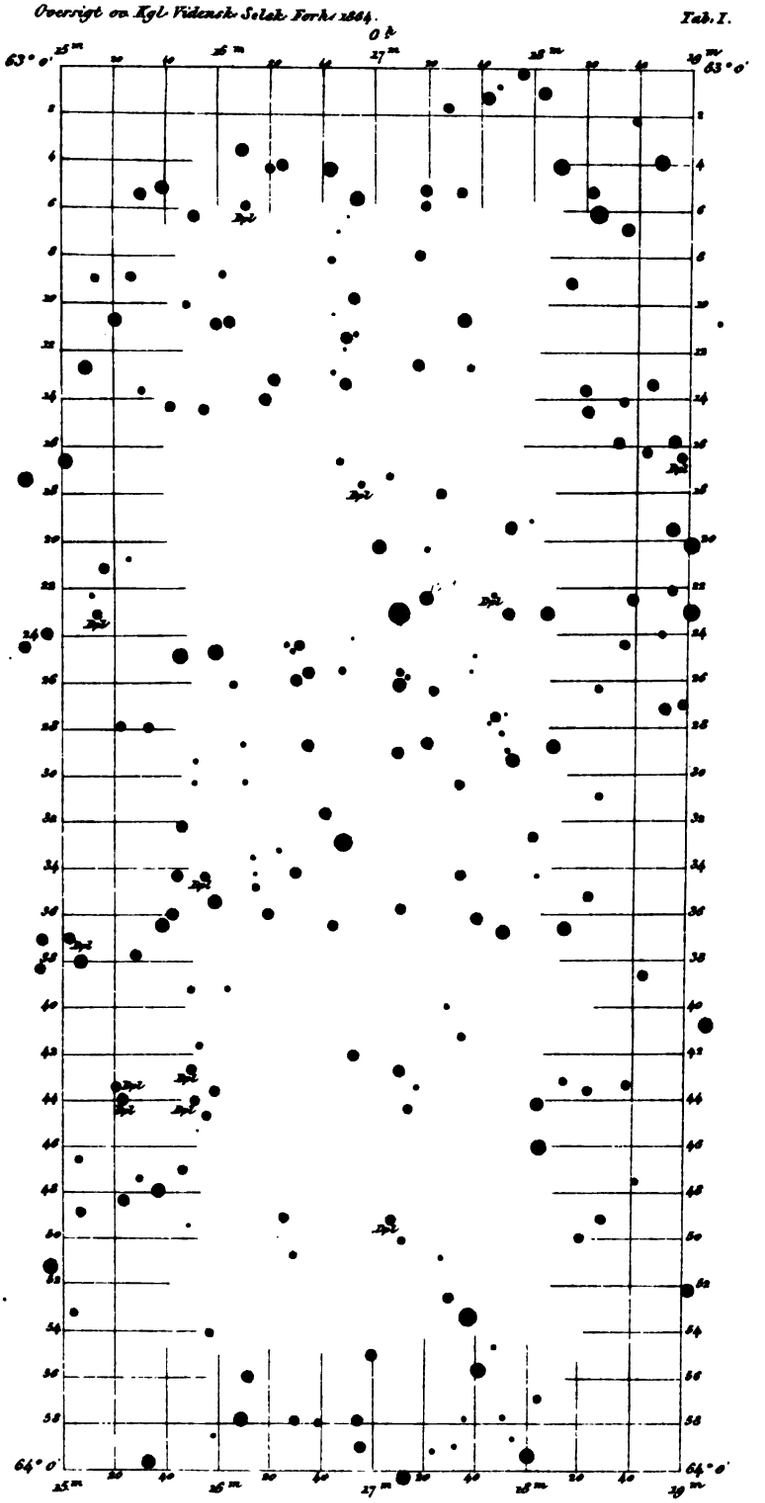

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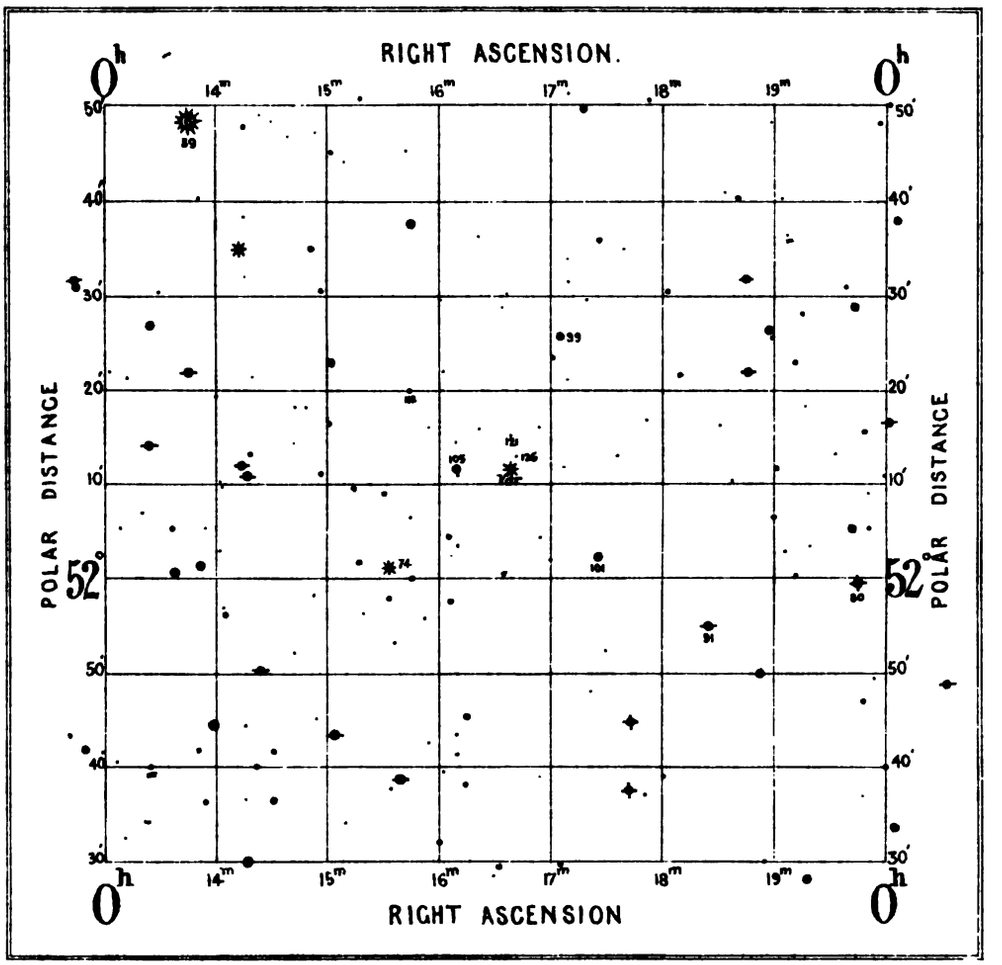
R ANDROMEDÆ VAR. 1.



RANGE—7th to

PERIOD—

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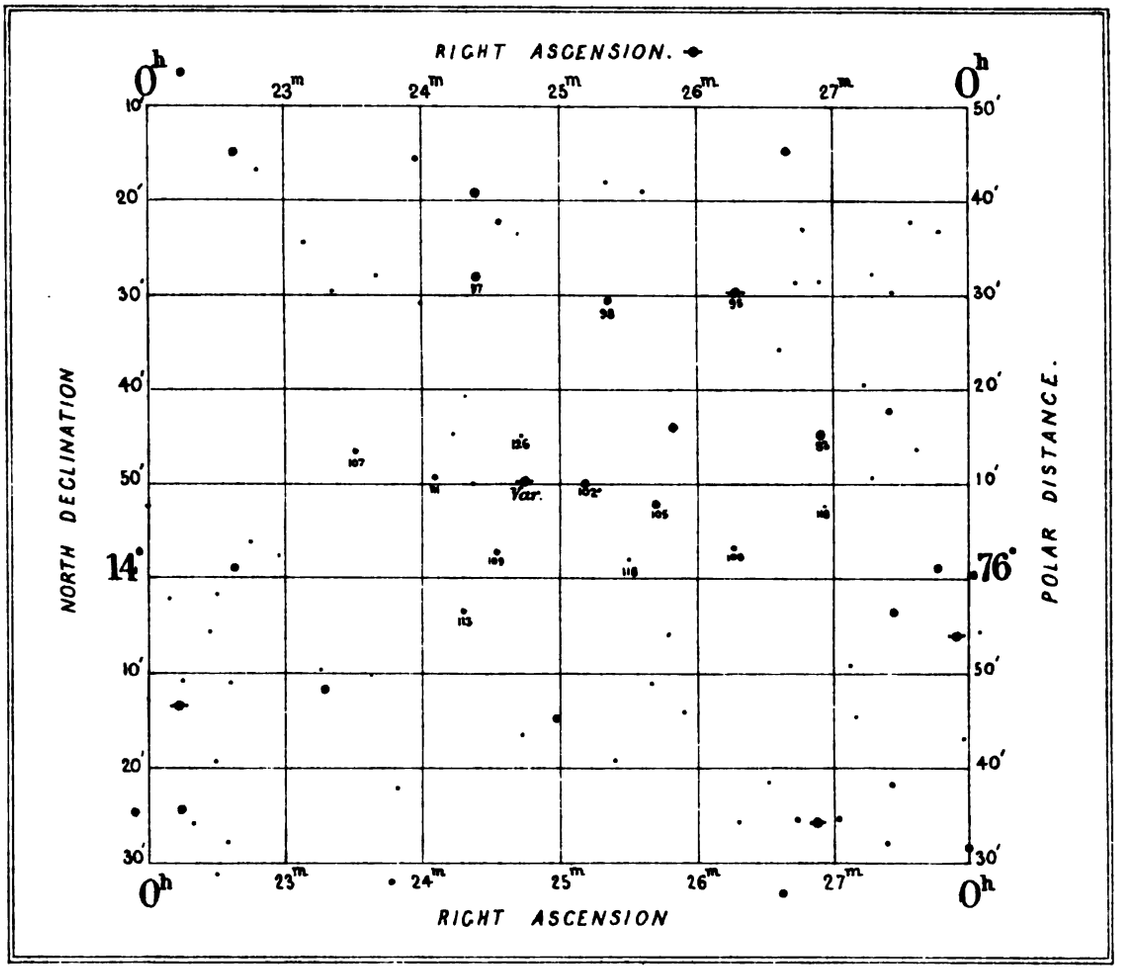
T PISCIUM . VAR . 3.



RANGE 9½ to 11th MAGNITUDE.

PERIOD 143 DAYS.

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PHOTO LITH BY A HOEN & CO

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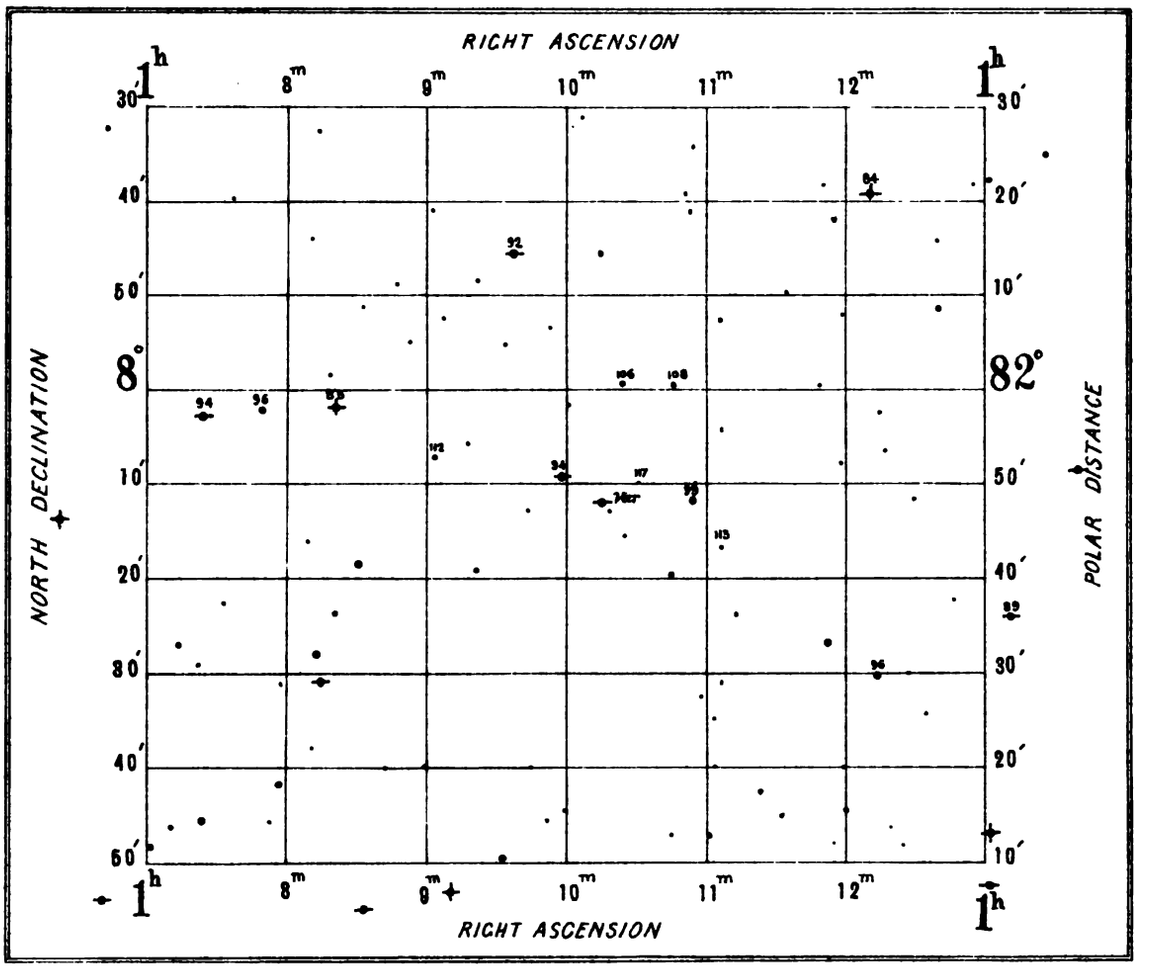
S. PISCIUM VAR. 2.



RANGE– 9th to 13th Magnitude.

PERIOD– 324 DAYS.

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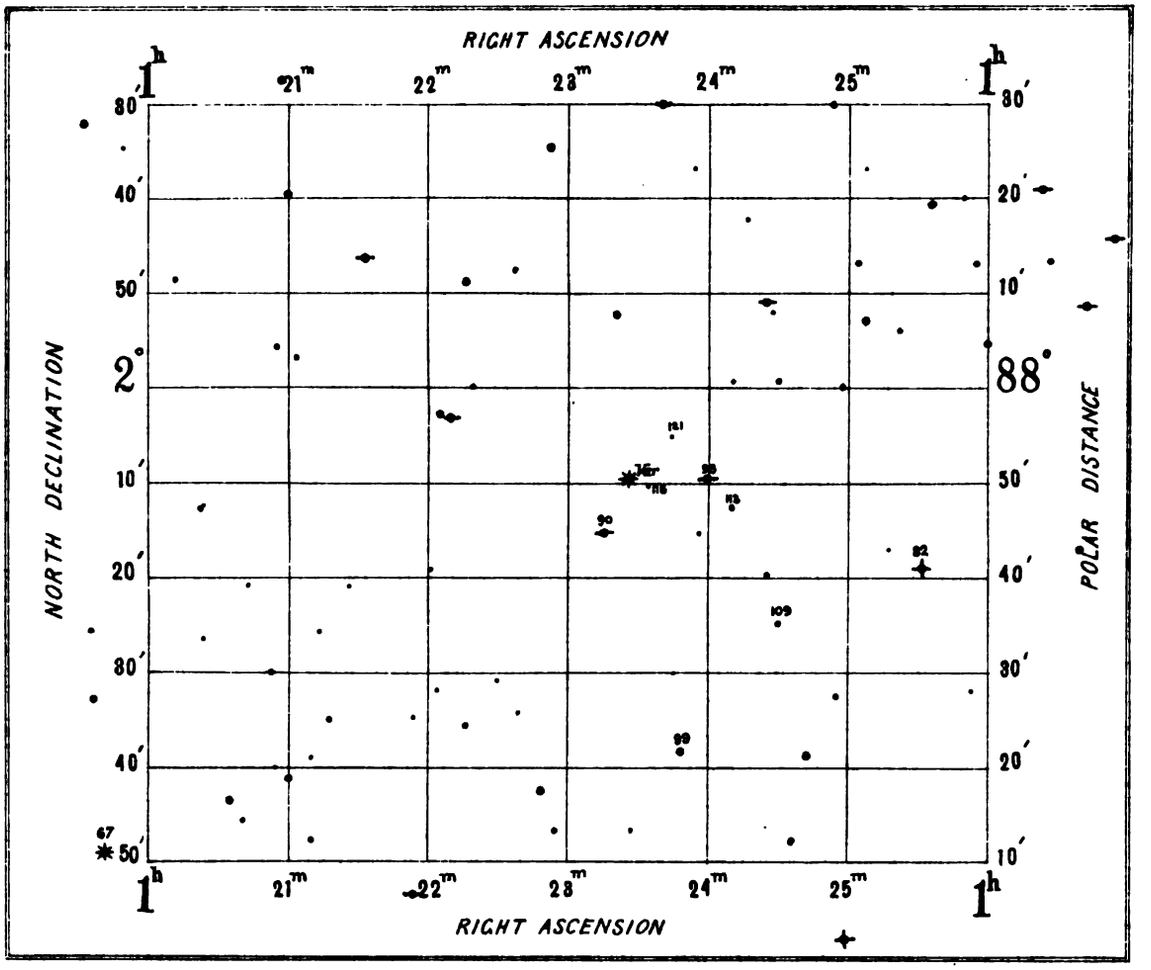
R. PISCIUM VAR. 1.



RANGE—7½ to 9½ Magnitude.

PERIOD—343 DAYS.

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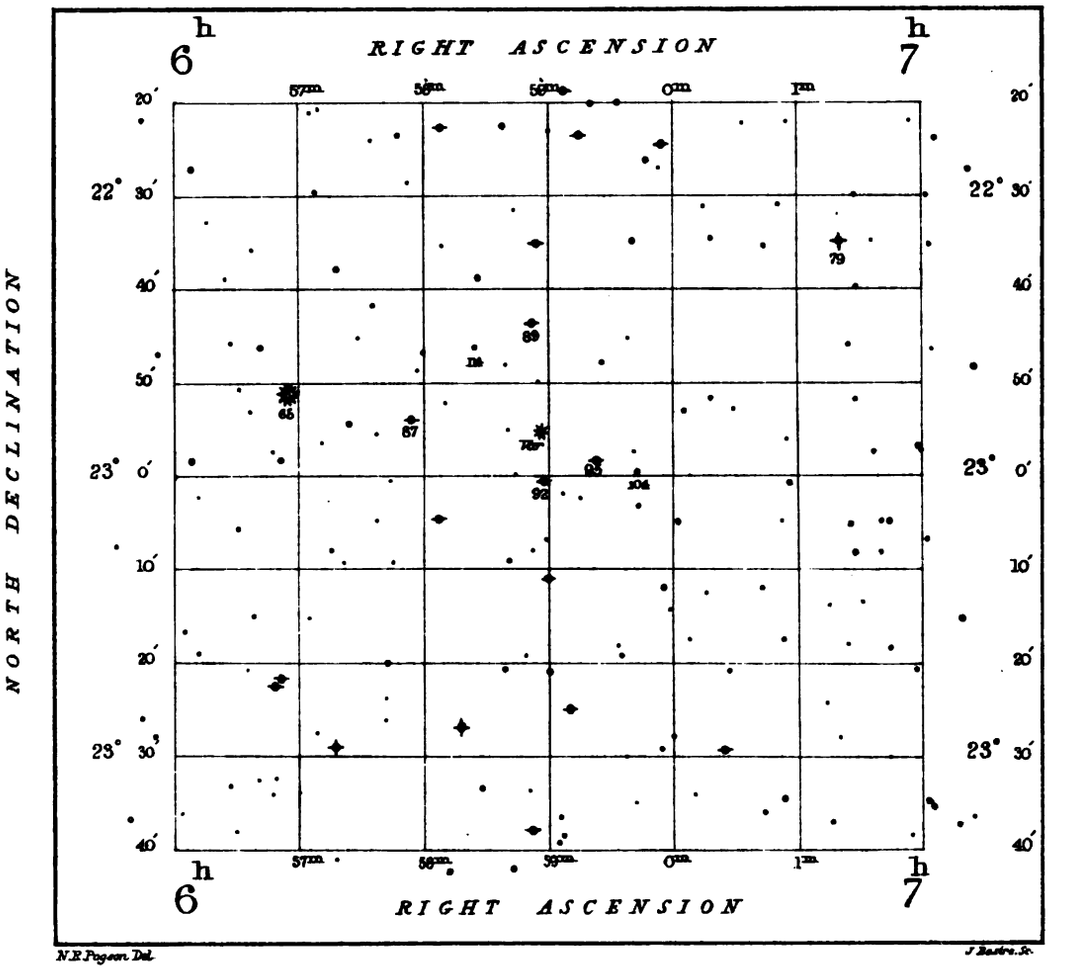
GEMINI. VAR. 2.



RANGE — 7th to 11th MAGNITUDE.

PERIOD 371 DAYS.

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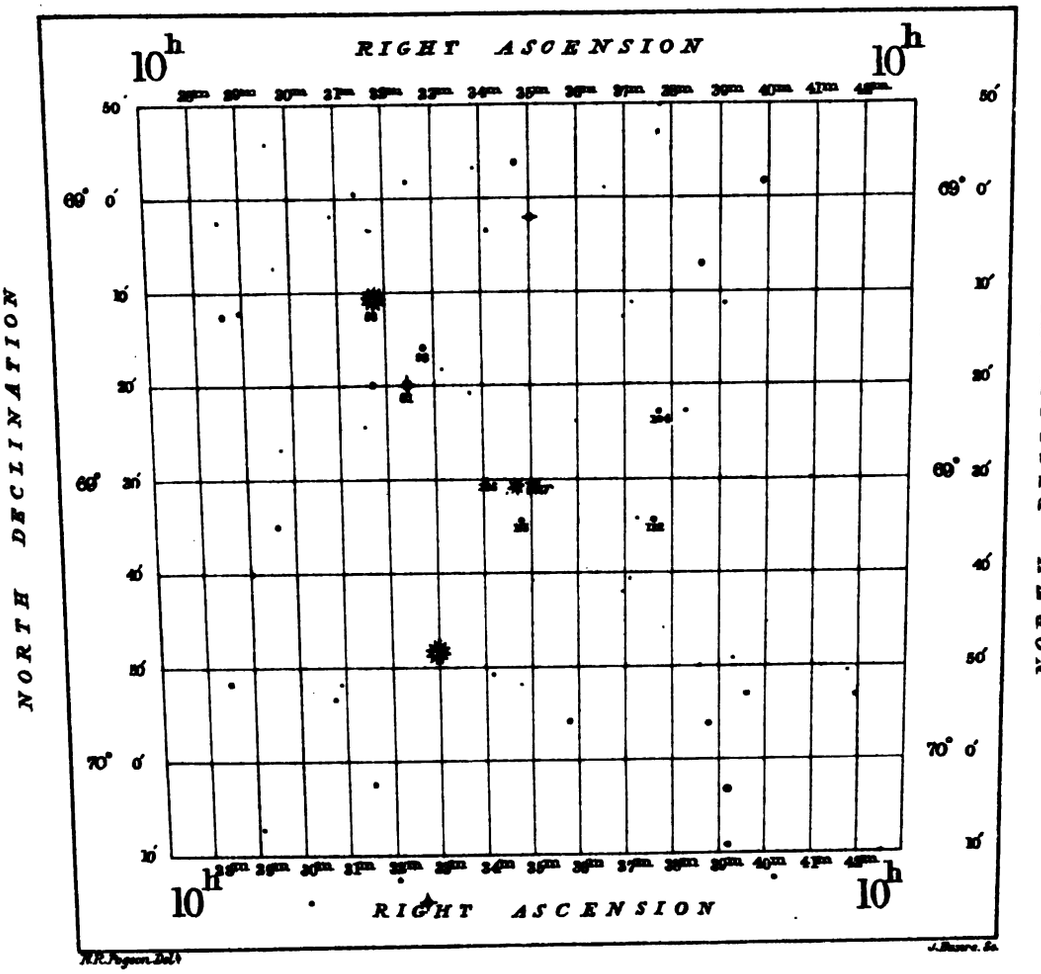
URSA MAJOR. VAR. 1.



RANGE 7th to 13th MAGNITUDE.

PERIOD 302 DAYS.

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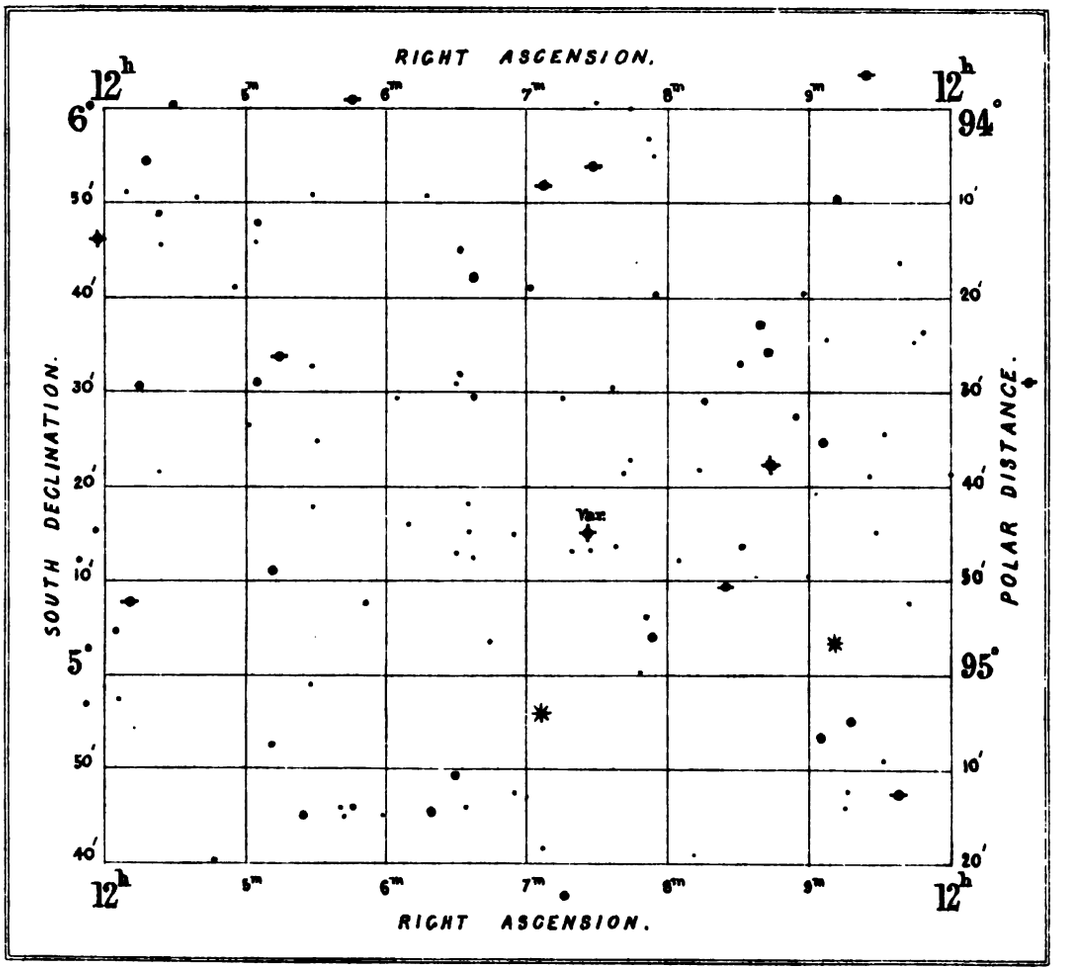
T VIRGINIS VAR. 4.



RANGE _ 8·5 to below 14$^{th}_{m}$ Magnitude.

PERIOD 337 DAYS.

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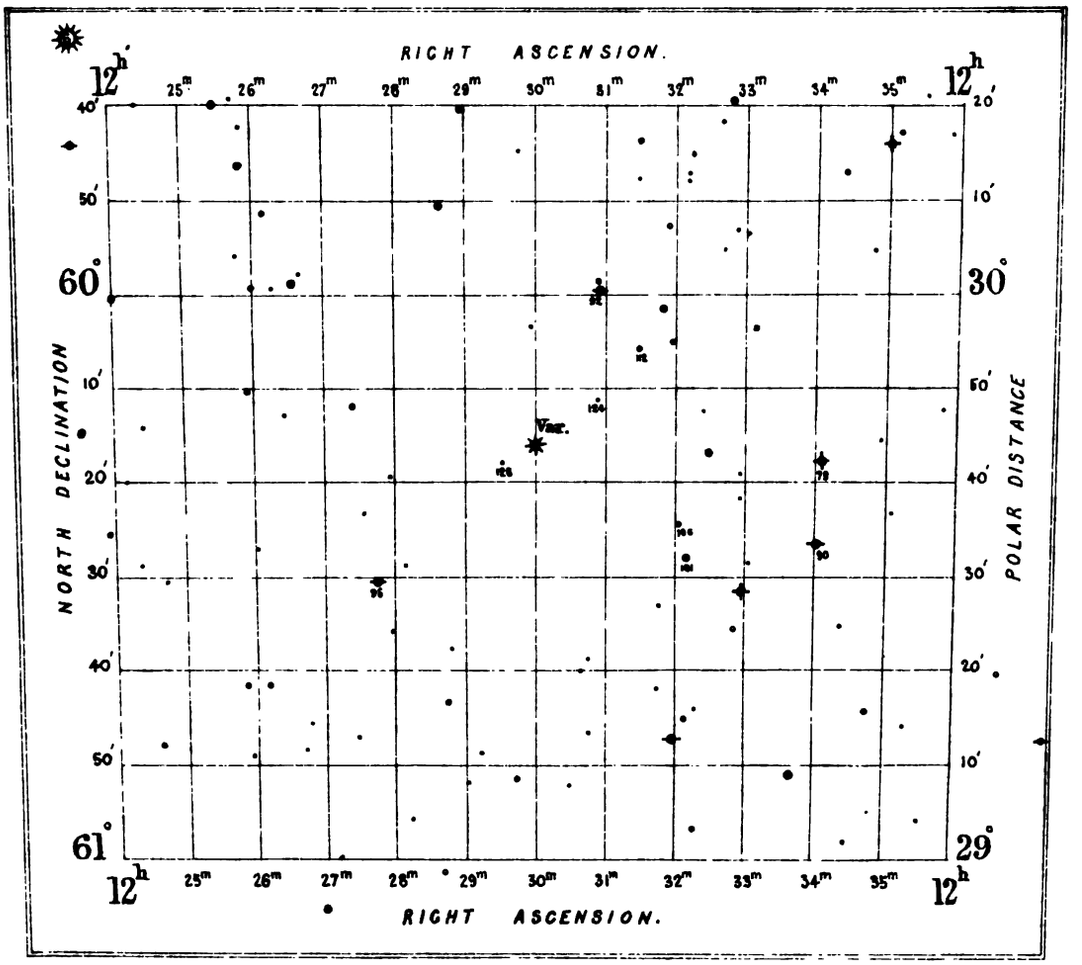
T URSÆ MAJORIS. VAR.3.



RANGE _ 6·5 to below 13th Magnitude.

PERIOD 257 DAYS.

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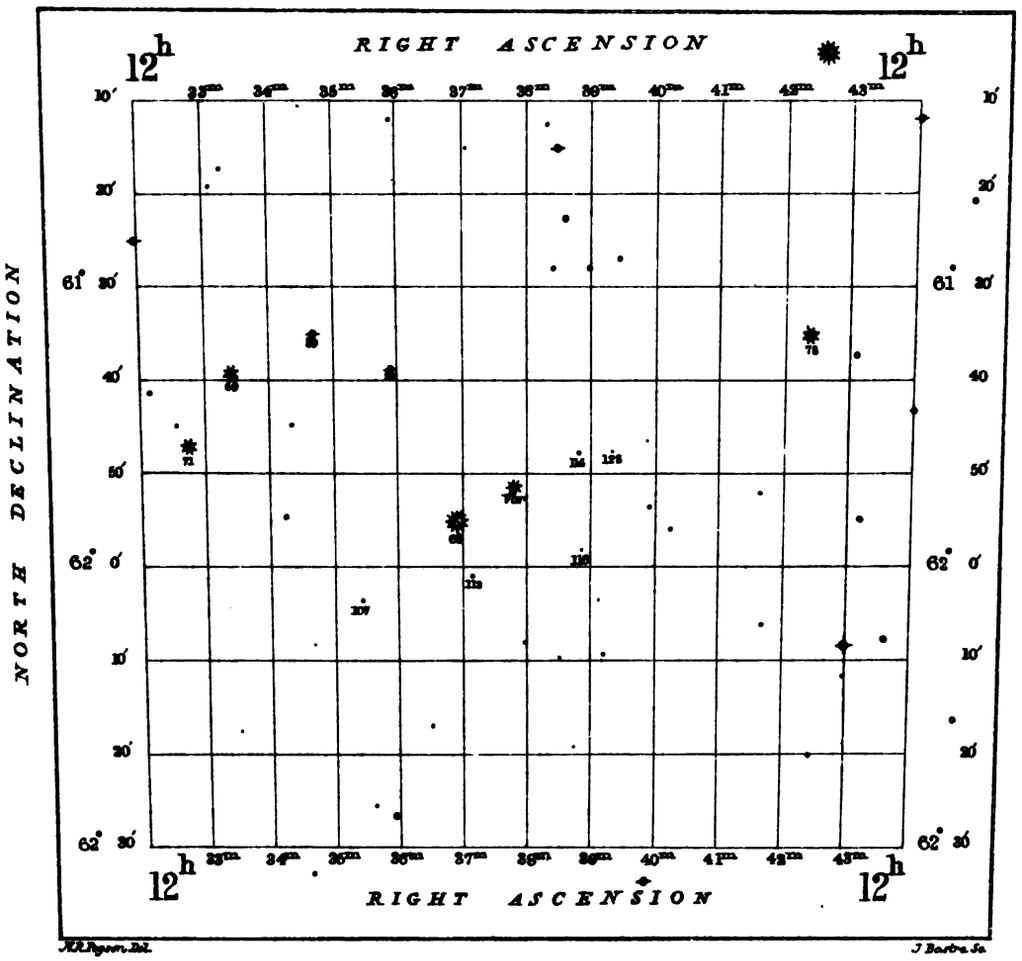
URSA MAJOR. VAR. 2.



RANGE 7th to 12th MAGNITUDE.

PERIOD 226 DAYS.

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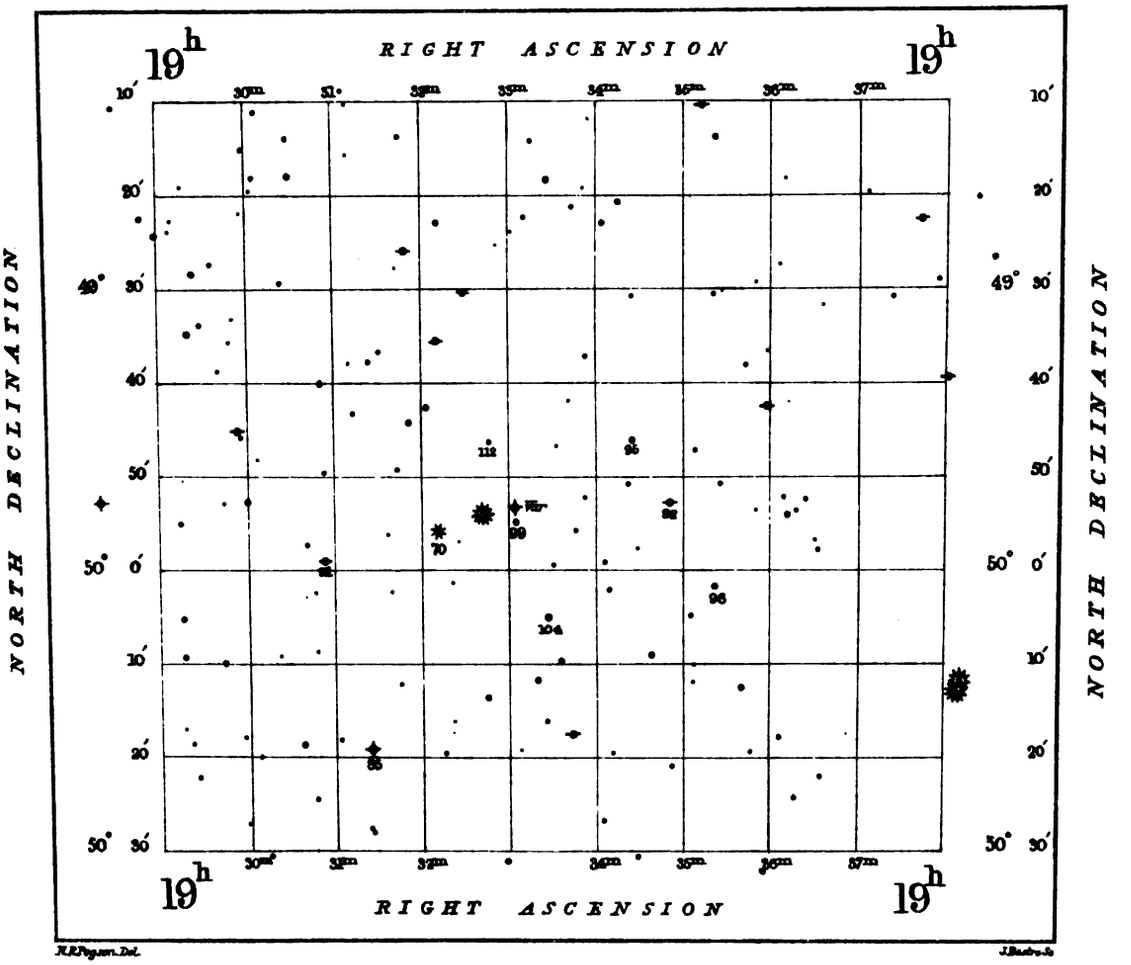
CYGNUS. VAR. 3.



RANGE — 8th to 14th MAGNITUDE.

PERIOD 416 DAYS.

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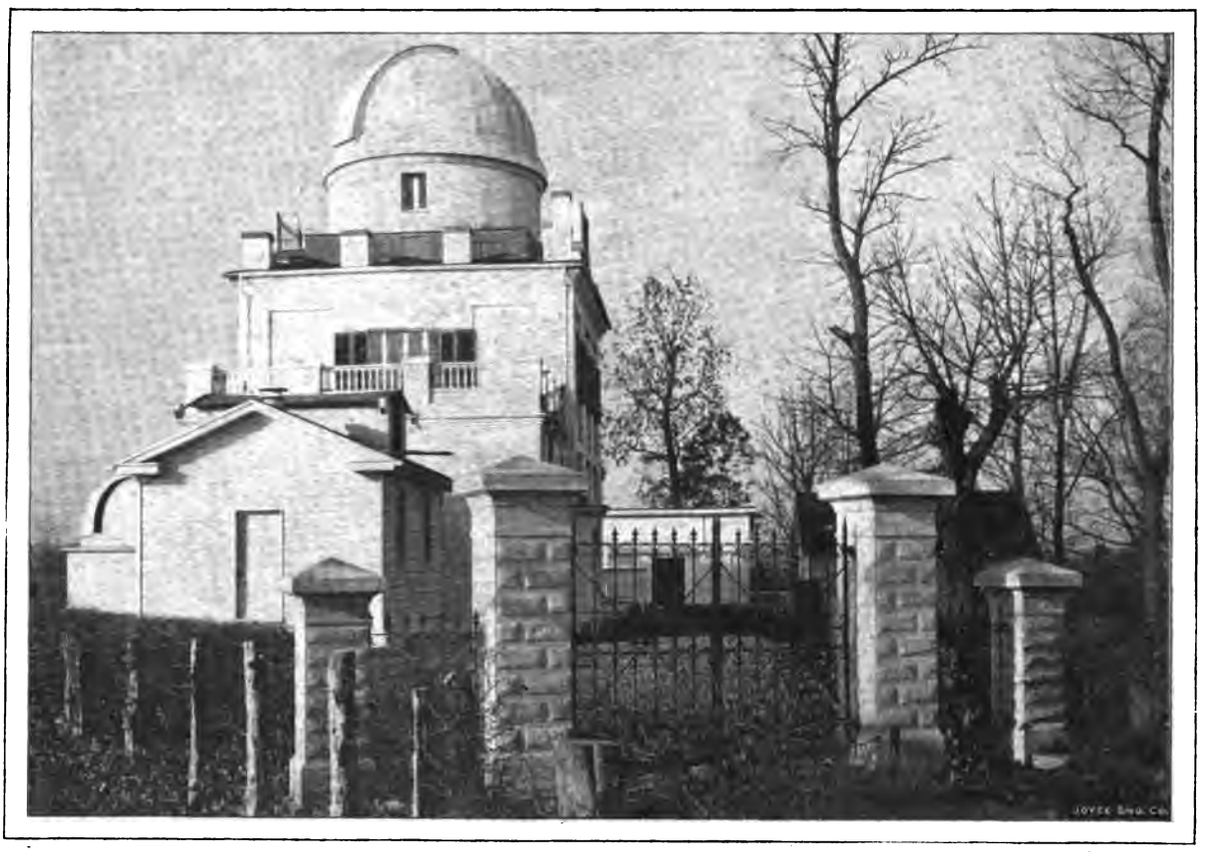

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